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BURMA MOSSES[1]

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During recent years Mr. F. G. Dickason has been collecting mosses in Burma in cooperation between the Arnold Arboretum of Harvard University and Judson College, Rangoon, Burma. No outline of the Burma moss flora has ever been published so these numerous collections supplemented by a small series from the Burma-Tibet Frontier made by Mr. F. Kingdon Ward with the C. Suydam Cutting Expedition of the Field Museum of Natural History and a few earlier collections of Mr. Dickason received from Mr. A. J. Sharp of the University of Tennessee form the basis for an important and significant study.

The area is an important one in relation to the geographical distribution of Indo-Malayan mosses and in some respects seems to represent a center in which a number of unusual types have originated. *Cleistostoma ambigua* (Hook.) Brid. and *Penzigiella cordata* (Harv., Hook.) Fleisch. are instances.

One of the especially interesting facts resulting from these studies is the occurrence in Burma of *Pseudosymblepharis pervaginata* Broth., *Pseudopohlia bulbifera* Williams, *Anomobryum gemmigerum* Broth. and *Calyptothecium himantocladioides* Bartr. It is altogether probable that these four supposedly endemic Philippine species had their origin in Burma. Such instructive range extensions illustrate again the strong west to east trend of distribution extending from the Himalayas through Indo-Malaya, the Philippines and the Pacific Islands to Hawaii. The collections recorded here total 133 species and are probably broadly representative of the Burma moss flora as a whole. Of this total 74 species or well over half the number are known from the Philippines.

Types of the new species are deposited in the Farlow Herbarium of Harvard University and in the herbarium of the author.

Unless otherwise indicated in the following list the collector is Mr. F. G. Dickason.

[1] Contribution from the Laboratories of Cryptogamic Botany and the Farlow Herbarium, Harvard University, no. 160.

SPHAGNACEAE

Sphagnum subsecundum Nees.

Mt. Victoria, Chin Hills, wayside, 9000 ft., no. *8512.*
Distribution: Europe, Asia, North America.

FISSIDENTACEAE

Fissidens sylvaticus Griff.

Taunggyi, F. S. S., damp open slope, no. 8787-C-1; Kamayut, Rangoon, damp shady ground, 60 ft., no. *9600.*
Distribution: Siam, Sumatra, Celebes, Java, Borneo, Hongkong, Philippines.

Fissidens nobilis Griff.

Sin Lum Kaba, no. *117.*
Distribution: Himalayas, Sumatra, Java, Hongkong, Philippines.

DITRICHACEAE

Garckea phascoides (Hook.) C. Müll.

Rangoon, along ditch during the rains, 20 ft., no. *6536;* Tavoy, mountain side, 20 ft., no. *7983;* Rangoon, shady area, 60 ft., no. *9602, 9603, 9604;* Rangoon, Kamayut, damp ground, 30–40 ft., no. *8663, 8669.*
Distribution: wide in southern Asia, Malaysia, Philippine Islands.

DICRANACEAE

Trematodon longicollis Michx.

Pyin Mana, Kyauk-Than-Ba, Pyin Ma Na, wet shady place, 1000 ft., no. *7122.*
Distribution: eastern United States, Mexico, Cuba, Italy, Ceylon, Philippines.

Campylopus gracilis (Mitt.) Jaeg.

Loimwe, Kentung State, epiphytic, 6500 ft., no. *9741–3;* Nataung, Kareni State, on tree, 5000 ft., no. *9421.*
Distribution: Sikkim.

Campylopus laetus (Mitt.) Jaeg.

Mount Popa, on rock, 3500 ft., no. *6615.*
Distribution: Khasia.

Campylopus umbellatus (W. Arn.) Bartr.

Sin Lum Kaba, 6000 ft., no. *109.*
Distribution: wide and frequent through the Pacific Islands and Malaysia.

Dicranodontium uncinatum (Harv.) Jaeg.

Pang Yang, Manglon State, 5500 ft., no. *9689.2, 9694-A;* Pang Yang,

Manglon State, epiphyte, 5000 ft., no. *9647;* Saw Chaung, Chin Hills, on tree, 6000 ft., no. *8556.*

Distribution: India, Siam, Java, Moluccas, Philippines.

Holomitrium Griffithianum Mitt.

Pang Yang, Manglon State, 5500 ft., no. *9689.3.*

Distribution: Bhotan, Assam, Khasia, Formosa.

Dicranum gymnostomum Mitt.

Burma-Tibet Frontier, Adung Valley, 12000 ft., Abies-Rhododendron forest, *F. Kingdon Ward,* 1930–31.

Distribution: Himalayas, Yunnan.

Dicranoloma fragile (Hook.) Broth.

Loi Se, Manglon State, epiphyte, 4000 ft., no. *9650;* Pang Yang, Manglon State, moist banks, 5000 ft., no. *9657, 9675;* Mong Pawk, Kengtung State, epiphytic, 4000 ft., no. *9825.1.*

Distribution: Himalayas, Annam, Philippines.

LEUCOBRYACEAE

Leucobryum Hollianum Doz. & Molk.

Zokhua (Haka), dry banks, 4800 ft., no. *7489.*

Distribution: Java, Borneo.

Leucobryum scalare C. Müll.

Tavoy, 18 miles down, on trees, 1000 ft., no. *8012* in part; Mong Pawk, Kengtung State, on ground in woods, 4000 ft., no. *9824;* Pang Yang, Manglon State, epiphytic, 5000 ft., no. *9673, 9659-C;* Nataung, Kareni State, *9422-B.*

Distribution: Nepal, Malacca, Siam, Java, Sumatra, Borneo, Philippines, Fiji.

Leucobryum neilgherrense C. Müll.

Loimwe, Kentung State, epiphytic, 6500 ft., no. *9741.2;* Sin Lum Kaba, no. *108.*

Distribution: India, Ceylon, Sumatra, Java, Celebes, Borneo, Philippines, China, Japan, Korea.

Octoblepharum albidum Hedw.

Rangoon, on trees, 30 ft., no. *6817.*

Distribution: cosmopolitan at low altitudes in tropical regions.

CALYMPERACEAE

Calymperes peguense Besch.

Rangoon, Royal Lake, on palm tree, 30 ft., no. *8665;* Rangoon, Royal Lake, on mango tree, 40 ft., no. *8668* in part.

Endemic.

Calymperes Hampei Bryol. Jav.

Toungoo, no. *101.*

Distribution: Malay Archipelago.

POTTIACEAE

Molendoa burmensis Bartr. sp. nov.

Gracilis, dense caespitosus, caespitibus fusco-viridis, haud nitidis. Caules ca. 2 cm. longi, flexuosi, inferne parce radiculosi. Folia sicca arcte crispata, humida erecto-patentia, 2–2.4 mm. longa, lineari-lanceolata, breviter acuminata, integerrima; marginibus uno latere anguste recurvis; costa pervalida, inferne ad 80 μ lata, percurrente; cellulae superiores leniter papillosae, irregulariter subquadratae vel ovales, parietibus pallidis, incrassatis, basilares rectangulares, pellucidae. Caetera ignota.

Goteik, Hsipaw, on rocks, 2800 ft., no. *9521* **type,** *9585.*

This species differs from *M. Roylei* (Mitt.) Broth. in several noticeable particulars. The leaves are strongly crisped when dry, the margin often recurved on one side below the middle and the costa twice as wide toward the base. Without fruit its position in *Molendoa* is problematical.

Anoectangium Stracheyanum Mitt.

Taunggyi, F.S.S., on damp area, 5200 ft., no. *8788, 8779, 8787-C-2.*

Distribution: Himalayas.

Trichostomum angustatum (Mitt.) Fleisch.

Taunggyi, F.S.S., damp ground, 4500 ft., no. *9071-A.*

Distribution: India, Ceylon, Java, Celebes, Philippines, South China.

Pseudosymblepharis pervaginata Broth.

Pang Wai, Kentung State, 6000 ft., no. *9699.1.*

Distribution: Philippines.

Timmiella anomala (Bry. Eur.) Limp.

Taunggyi, F.S.S., on rock, 5000 ft., no. *9359* in part.

Distribution: Europe, North America, Himalayas.

Tortella cyrtobasis Dix.

Taunggyi, F.S.S., on rock, 5000 ft., no. *9359a.*

Distribution: Siam.

Hyophila involuta (Hook.) Jaeg.

Taunggyi, F.S.S., on rocks, 5200 ft., no. *8790, 8794;* Taunggyi, F.S.S., on trees, 4500 ft., no. *9075;* Taunggyi, F.S.S., open damp ground, 4500 ft., no. *9094.1;* Rangoon, Kamayut, 40 ft., no. *8670;* Rangoon, Mingaladon, on bricks, 60 ft., no. *9610.1;* Rangoon, Inya Road, on rocks, 60 ft., no. *9598.*

Distribution: India, East China, Philippines.

Barbula indica (Schwaegr.) Brid.

Rangoon, open damp earth, 40 ft., no. *8661.*

Distribution: India, Ceylon, Java, Borneo, Philippines, East China.

Barbula constricta Mitt.

Taunggyi, F.S.S., damp ground and open slopes, 4500–5200 ft., no. *8789, 9063, 9097.*

Distribution: Himalayas, Philippines.

Barbula consanguinea (Thw. & Mitt.) Jaeg.

Rangoon, Mingaladon, on bricks, 60 ft., no. *9601;* Taunggyi, F.S.S., open damp ground, 4500–5200 ft., no. *8787-A, 9094, 9062, 9099.1.*

Distribution: Ceylon, Singapore, Java, Philippines.

Desmatodon involutus Bartr. sp. nov.

Pusillus, dense caespitosus, flavescenti-viridis, haud nitidulus. Caulis brevis, dense foliosus. Folia sicca leniter contorta, humida erecto-patentia, oblongo-ovata, concava, apice truncata vel rotundata, haud mucronata, inferiora minuta, superiora, ca. 1 mm. longa; marginibus integerrimis, superne late inflexis; costa 35–40 μ lata, infra apicem soluta; cellulae superiores rotundato-quadratae, mamillosae, dorso laeves, diam. 7–8 μ, basilares rectangulares, laevissimae, pellucidae. Folia perichaetialia caulinis similia, seta 6–7 mm. longa, aureo-rubella, laevissima; theca erecta, oblongo-ovalis, deoperculata 1–1.2 mm. longa; peristomii dentes 16, erecti, pallidi, papillosi, ad 150 μ longi; operculum rubrum, conico-rostratum, ca. 0.5 mm. longum; annulus latus, calyptra cucullata, spori laeves, diam. 7–8 μ.

Taunggyi, F.S.S., damp open slope, 5200 ft., no. *8787-B, 8795* **type.**

In *Desmatodon* this species is unique in the broadly rounded or truncate leaves with the margins widely inflexed above. The costa in cross section shows the typical structure with a stereid band on the dorsal side only; the leaf cells are smooth on the back and mamillose on the ventral side and there is nothing unusual in the peristome characters. On the whole it seems more appropriate to include the species in *Desmatodon* than to create a new monotypic genus.

FUNARIACEAE

Entosthodon wichurae (Broth.) Fleisch.

Taunggyi, F.S.S., damp ground, 4500 ft., no. *9072, 9078, 9500.* Nataung, Kareni State, open dry ground, 5000 ft., no. *9427.*

Distribution: Java.

Funaria hygrometrica Hedw. var. **calvescens** (Schwaegr.) Bry. Eur.

Mt. Nwalabo, Tavoy, on tree, 5000 ft., no. *8205;* Nataung, Kareni State, open damp earth, 5000 ft., no. *9487;* Wunba Taung, Chin Hills, on rocks, 7900 ft., no. *8481, 8491.*

Distribution: cosmopolitan in warm regions.

SPLACHNACEAE

Tayloria indica Mitt.

Haka, on trees and rocks, 5100–7000 ft., no. *7401, 7583.*

Distribution: Himalayas, Philippines.

BRYACEAE

Pseudopohlia bulbifera R. S. Williams

Taungteik (Falam), damp banks, 4500 ft., no. *7548;* Yetagone, along the damp, shady path, 4000 ft., no. *7801a.*

Distribution: Philippines.

Brachymenium acuminatum Harv.

Taunggyi, F.S.S., damp ground, 4500 ft., no. *9071.B, 9083.1.*

Distribution: East India, Philippines.

Brachymenium nepalense Hook.

Taunggyi, F.S.S., no. *7891;* Nataung, Kareni State, on trees, 5000 ft., no. *9426-A;* Pang Yang, Manglon State, on bank and epiphytic, 5000–5500 ft., no. *9686, 9689, 9693.1, 9815.2; 9814-A;* Hopong, Hopong State, no. *8276b.*

Distribution: East India, Siam, Sumatra, Java, Borneo, Philippines, Celebes.

Anomobryum gemmigerum Broth.

Taunggyi, F.S.S., open damp area, 4500 ft., no. *9083.*

Distribution: Philippines.

Anomobryum cymbifolium (C. Müll.) Broth.

Taunggyi, F.S.S., damp ground, 4500 ft., no. *9066.*

Distribution: Himalayas, South India, Khasia, Java, Philippines, Amboina.

Bryum argenteum Hedw. var. **lanatum** Bry. Eur.

Taunggyi, F.S.S., on damp ground, 4500 ft., no. *9079, 9089.*

Distribution: cosmopolitan.

Bryum nitens Hook.

Taunggyi, F.S.S., on trees, 4500 ft., no. *9095.1.*

Distribution: Nepal, Ceylon, Java.

Bryum coronatum Schwaegr.

Taunggyi, F.S.S., open damp slope, 4500 ft., no. *9088, 9099;* Rangoon, Inya Road, on bricks, 60 ft., no. *9599.*

Distribution: cosmopolitan in tropical and subtropical regions.

Bryum porphyroneuron C. Müll.

Taunggyi, F.S.S., damp ground, 4500 ft., no. *9503-A.*

Distribution: India, Ceylon, Sumatra, Java.

Bryum ramosum (Hook.) Mitt.

Thandaung, usually found on rocks of cold places, 3500 ft., no. *6738.* Loimwe, Kentung State, epiphytic, 6500 ft., no. *9741.1.*

Rhodobryum giganteum (Hook.) Schp.

Mong Yang, Kengtung State, damp soil in forest, 3500 ft., no. *9862;* Mong Yang, Kengtung State, epiphyte, 3500 ft., no. *9863.A.1;* Webula, along damp trails, no. *7786;* Taungteik (Falam), damp shady banks, 4000 ft., no. *7756;* Taunggyi, South Shan States, along the path, 5300 ft., no. *8398;* Nataung, Kareni State, on damp areas, 5000 ft., no. *9435;* Burma-Tibet Frontier, *F. Kingdon Ward,* Coll.

Distribution: Himalayas, Sumatra, Java, Borneo, Philippines, China, Japan, Hawaii.

MNIACEAE

Orthomnium trichomitrium Wils.

Nataung, Kareni State, shady forest, 6300 ft., on trees, no. *9448.1.*

Distribution: Sikkim, Khasia.

Mnium Thomsoni Schp.

Burma-Tibet Frontier, *F. Kingdon Ward,* Coll. 1930–31.

Distribution: Sikkim, Yunnan, Japan.

Mnium rostratum Schrad.

Webula, rocky wet places, 4000 ft., no. *7788;* Pang Wai, Kengtung State, 6000 ft., no. *9690, 9699.5;* Pang Yang, Manglon State, epiphytic, 5000 ft., no. *9656;* Loimwe, Kantung State, epiphytic, 6500 ft., no. *9741.*

Distribution: cosmopolitan.

Mnium coriaceum Griff.

Haka, damp banks, 6200 ft., no. *7294.*

Distribution: Himalayas, Khasia.

BARTRAMIACEAE

Bartramia Halleriana Hedw.

Wunba Taung, Chin Hill, no. *8482b.*

Distribution: Europe, North America, South America, Himalayas, Yunnan, New Guinea, New Zealand.

Philonotis Griffithiana (Wils.) Mitt.

Nataung, Kareni State, on open damp earth, 5000 ft., no. *9485.*

Distribution: Himalayas, Khasia.

Philonotis (Philonotula) **aristifolia** Bartr. sp. nov.

Dioica videtur. Densissime caespitosa, caespites superne laete viridi, intus fusci. Caules ad 4 cm. alti. Folia late patentia, saepe falcata, angustissime lineari-lanceolata, ca. 2 mm. longa, 0.3 mm. lata, sensim acuminata, longe aristata; margines leniter recurvi, denticulati; cellulae superiores lineares, papillosae, inferne sensim latiores; costa valida, in aristam denticulatam longe excurrens. Seta 3 cm. alta; theca magna, inclinata vel horizontalis, fortiter plicata; peristomium duplex.

Langoon, Insein, on damp earth, no. *8158;* Mt. Nwalabo, Tavoy, on damp earth, 5000 ft., no. *8203* **type.**

Differs radically from *P. angusta* Mitt. of Ceylon in the longer, narrower more widely spreading aristate leaves with longer cells. The type collection is richly fruited and is an unusually handsome little plant for the genus with a delicate silky appearance due to the slender spreading foliage.

Philonotis imbricatula Mitt.

Taunggyi, F.S.S., open damp area, 4500 ft., no. *9494.*

Distribution: Ceylon, Hongkong, Philippines, Fiji.

Philonotis perlaxifolia Dix. ?

Rangoon, Royal Lake, on mango tree, 30 ft., no. *8666.*

Distribution: Siam.

As this collection is sterile the determination is open to doubt.

Philonotis falcata (Hook.) Mitt.

Taungteik (Falam), wet bank, 4500 ft., no. *7237.* Falam, damp bank, 6000 ft., no. *7324.*

Distribution: North India, China, Japan, Philippines, Hawaii.

Philonotis Turneriana (Schwaegr.) Mitt.

Taungteik, damp banks, 4500 ft., no. *7237.A;* Naungkhio, Thibaw State, on rocks in moist localities, 2800 ft., no. *9536.*

Distribution: Himalayas, Khasia, Java, Japan, China, Hawaii.

Philonotis speciosa (Griff.) Mitt.

Yetagone, along the damp shady path, 4000 ft., no. *7801.*

Distribution: Nepal, Khasia, Philippines.

Fleischerobryum longicollis (Hampe) Loeske

Burma-Tibet frontier, *F. Kingdon Ward,* Coll.

Distribution: Himalayas, Java.

ORTHOTRICHACEAE

Macromitrium nepalense (Hook. & Grev.) Schwaegr.

Pang Yang, Manglon State, epiphyte, 5000 ft., no. *9816;* Mong Pawk, Kentung State, epiphytic in woods, 4000 ft., no. *9823.*

Distribution: Nepal, Sikkim, Siam, Malay Peninsula, China, Philippines.

Macromitrium Dickasonii Bartr. sp. nov.

Caulis repens, ramis erectis, ca. 5 mm. altis, fusco-viridibus. Folia sicca arcte crispata, humida erecto-patentia, apice incurva, 2.5 mm. longa, oblongo-lanceolata, acuta, integerrima, profunde canaliculata; costa infra apicem evanida; cellulae superiores minutae, obscurae, papillosae, basilares magis incrassatae, laevissimae, marginales angustissime lineares, in costam versus breviores. Seta crassa, rubra, laevissima, 6–7 mm. longa; theca oblongo-ovalis, laevis, macrostoma, castanea,

2–2.5 mm. longa; peristomii simplicis, dentes ad 165 μ longi, obtusi, sordide albidi, papillosi; calyptra dense pilosa; spori minute papillosi, diam. ad 30 μ.

Mogok, Apr. 1934, no. *102,* **type.**

Near *M. falcatulum* C. Müll. of the Philippines but with elongated basal cells, longer setae and longer capsules.

Macromitrium sulcatum (Hook.) Brid.

Nataung, Kareni State, on trees, 5000 ft., no. *9431;* Nataung, Kareni State, on trees, shady forest, 6300 ft., no. *9447-B, 9448;* Pang Yang, Manglon State, moist bank, 5000 ft., no. *9654;* Pang Yang, Manglon State, 6000 ft., no. *9694-C;* Haka, damp banks, 6200 ft., no. *7584.*

Distribution: East India, Ceylon, Malay Peninsula, Borneo, Philippines.

Macromitrium goniorhynchum (Doz. & Molk.) Jaeg.

Kalaw, 5000 ft., no. *115.*

Distribution: Khasia through Malaysia to the Philippines and New Guinea.

RHACOPILACEAE

Rhacopilum Schmidii (C. Müll.) Jaeg.

Hopong, Hopong State, on trees, no. *8276;* Taunggyi, F.S.S., on trees, 5000 ft., no. *8775;* Mong Yang, Kengtung State, epiphyte, 3500 ft., no. *9876.*

Distribution: Nilghiri, Tonkin, Philippines.

HEDWIGIACEAE

Cleistostoma ambigua (Hook.) Brid.

Sin Lum Kaha, 6000 ft., no. *124;* Taunggyi, F.S.S., on rocks, 6000 ft., no. *7848;* Nataung, Kareni State, on trees, shady slope, 5000 ft., no. *9425;* Pang Yang, Manglon State, on trees, 5500 ft., no. *9642-A.*

Distribution: Himalayas, West China, Siam, Assam.

TRACHYPODACEAE

Diaphanodon thuidioides Ren. & Card.

Mt. Victoria, Chin Hills, on trees, 10000 ft., no. *8523a.*

Distribution: Sikkim.

Trachypus bicolor Reinw. & Hornsch.

Pang Yang, Manglon State, damp soil, 5000 ft., no. *9659-A;* Pang Yang, Manglon State, epiphytic, 5000 ft., no. *9815;* Pang Yang, Manglon State, 6000 ft., no. *9713;* Pang Wai, Kentung State, 6000 ft., no. *9699.4;* Nataung, Kareni State, on trees, 5000 ft., no. *9431.1;* Nataung, Kareni State, shady mountain slope on trees, 5000 ft., no. *9424;* Mt. Victoria, Chin Hills, on trees, 10000 ft., no. *8529.*

Distribution: North India, Ceylon, Siam, Java, Celebes, Philippines, China, Japan, Formosa, Hawaii.

Trachypodopsis crispatula (Hook.) Fleisch.

Haka, on trees and banks, 6200–6500 ft., no. *7293, 7427;* Taungteik (Falam), mountain side, 5000 ft., no. *7262;* Mt. Nwalabo, Tavoy, on rocks, 5000 ft., no. *8196;* Mt. Victoria, Chin Hills, on trees, 10000 ft., no. *8523;* Loi, Maing, Sampu, Namkhok State, epiphytic in mossy forest, 7500 ft., no. *8356,* a robust form with coarsely toothed leaves; Pang Wai, Kentung State, 6000 ft., no. *9699.2;* Pang Yang, Manglon State, 5500 ft., no. *9690.B.1;* Namkham, no. *103.*

Distribution: Himalayas, Yunnan, Ceylon, Andaman Islands, Philippines.

MYURIACEAE

Myurium rufescens (Reinw. & Hornsch.) Fleisch.

Pang Yang, Manglon State, 6000 ft., no. *9714;* Pang Yang, Manglon State, epiphytic, 5000 ft., no. *9815.1;* Nataung, Kareni State, on trees, shady forest, 6300 ft., no. *9447-C.*

Distribution: Khasia, Ceylon, Siam, wide in Malaysia, Philippines, Australia, New Caledonia.

PTEROBRYACEAE

Penzigiella cordata (Harv.) Fleisch.

Haka, mossy forest, 7625 ft., no. *7500a;* Pang Yang, Manglon State, epiphyte, 5000 ft., no. *9818.*

Distribution: Sikkim, Nepal, Khasia.

Endotrichella rigida Dix.

Nataung, Kareni State, on trees, shady forest, 6300 ft., no. *9446.*

Distribution: Siam.

Pterobryopsis (Eupterobryopsis) **caudata** Bartr. sp. nov.

Dioica?, robusta, pallide virens, nitida. Caules secundarii ad 7 cm. alti, breviter stipitati, simplices, superne longe attenuati, arcuati. Folia humida late patentia, cochleariformia, ad 3 mm. longa, 2 mm. lata, e basi cordata late ovata, acuta; marginibus erectis, integris vel apice minutissime denticulatis; costa supra medium folii evanida; cellulae superiores lineari-rhomboideae, infimae laxiores, aurantiacae, alares nullae. Fructus ignotus.

Mt. Nwalabo, Tavoy, on trees, 5000 ft., no. *8202* **type;** Pang Yang, Manglon State, 5500 ft., no. *9693;* Nataung, Kareni State, on trees, shady forest, 6300 ft., no. *9448.2.*

A very unusual looking plant with the stems attenuate in a long, curved, microphyllous, proboscoid-like tip. Through the well defined costa it is probably nearest *P. crassicaulis* (C. Müll.) Fleisch. but the broad, short pointed leaves not inflexed on the margins above and without any well defined alar cells are thoroughly distinctive. I am not sure that nos. *9448.2* and *9693* belong here. In *9693* the stems are not caudate at the tips and in *9448.2* the habit is more slender. Both show the leaves more

slender than in the type collection and the upper margins are distinctly serrulate. Otherwise the form and structure of the leaves are very similar.

Pterobryopsis flexipes (Mitt.) Fleisch.

Nataung, Kareni State, on trees, shady forest, 6300 ft., no. *9446.1.*
Distribution: Nilghiri, Ceylon.

Pterobryopsis acuminata (Harv.) Fleisch.

Sin Lum Kaba, no. *119.*
Distribution: Sikkim, Nepal, Khasia, Nilghiri.

Pterobryopsis orientalis (C. Müll.) Fleisch.

Taunggyi, F.S.S., on rocks, 4700–5000 ft., no. *7872, 9021;* Haka, on trees, 6400 ft., no. *7443;* Pang Yang, Manglon State, 5500 ft., no. *9685, 9695-A;* Mt. Popa, 4000 ft., no. *125.*
Distribution: Himalayas, Nilghiri, Assam.

METEORIACEAE

Papillaria fuscescens (Hook.) Jaeg.

Haka, on trees, 6200–7625 ft., no. *7296, 7426, 7499a, 7503;* Thandaung, Taungoo, on rocks, 4000 ft., no. *8180;* Nawrig Heng, Yunnan, China, no. *123;* Nataung, Kareni State, on trees, shady forest, 5800–6300 ft., no. *9436, 9447-A.*
Distribution: Himalayas, Ceylon, Yunnan, Siam, Malaysia, Philippines.

Papillaria (Eupapillaria) **lanosa** Bartr. sp. nov.

Tenella, pallide lutescens vel subfusca, haud nitida. Caulis secundarius remote et irregulariter ramosus, ad 5 cm. longus, flexuosus. Folia sicca laxe adpressa, humida erecto-patentia, leniter plicatula, oblongo-ovata, plerumque raptim longissime piliformiter attenuata, 2.5 mm. longa, 0.8 mm. lata, canaliculato-concava; margines inferne late inflexi, superne erecti vel anguste incurvi, ubique remote et minute denticulati; cellulae lineares, obscurae, dense et humiliter papillosae, infimae solum laxiores, laevissimae, alares subquadratae, minutae, numerosae. Fructus unicus visus; seta brevis, 1 mm. longa, crassa; theca exserta, erecta, ovato-globosa, 1 mm. longa; operculum conico-rostratum, 1 mm. longum.

Pang Yang, Manglon State, epiphyte, 5500 ft., no. *9820,* **type.**

In a general way this species is suggestive of *P. Deppei* (Hornsch.) Jaeg. of tropical America but the distinctions are obvious. Here the leaves are more abruptly narrowed to the capillary hair point and the leaf cells much more obscure with numerous small papillae. In *P. Deppei* the papillae are sharp and salient and average 3 or 4 to a cell while in *P. lanosa* the papillae are low and so numerous as to almost obscure the cell structure.

Aerobryopsis longissima (Doz. & Molk.) Fleisch.

Mong Yang, Kengtung State, epiphyte, 3500 ft., no. *9875, 9877.*
Distribution: India, Ceylon, Malaysia, China, Philippines to Hawaii.

Aerobryidium aureo-nitens (Hook.) Broth.

Pang Wai, Kentung State, 6000 ft., no. *9699.3;* Taunggyi, F.S.S., on rocks and trees, 4500–5000 ft., no. *9355, 9360, 9507-A;* Pang Yang, Manglon State, 5500 ft., no. *9688;* Mt. Victoria, Chin Hills, on trees, 10000 ft., no. *8586;* Taungteik (Falam), mountain path side, 5000 ft., no. *7257;* Namkham, 4000 ft., no. *113;* Sin Lum Kaba, no. *104;* Mt. Popa, 4000 ft., no. *118.*

Distribution: Himalayas, Khasia, Nilghiri.

Floribundaria floribunda (Doz. & Molk.) Fleisch.

Haka, mossy forest, epiphytic, 7625 ft., no. *7495;* Pang Yang, Manglon State, 5500 ft., no. *9694-B;* N'Bapa, no. *111;* Sin Lum Kaba, 6000 ft., no. *122.*

Distribution: Africa, India, Malaysia, Japan, Tonkin, Philippines to Hawaii.

Floribundaria aurea (Griff.) Broth.

Burma-Tibet Frontier, Valley of Tamai River, 3000 ft., *F. Kingdon Ward,* Jan. 1931; Burma-Tibet frontier, Adung Valley, 12000 ft., uppermost Abies-Rhodendron forest, *F. Kingdon Ward,* 1930–31.

Distribution: Himalayas, Bhotan, Java, Celebes, Ceram, Japan.

Barbella enervis (Mitt.) Fleisch.

Mong Yang, Kengtung State, epiphyte, 3500 ft., no. *9874, 9869, 9863.B.1;* Mong Yang, Kengtung State, damp soil, 3500 ft., no. *9867.*

Distribution: Himalayas, Ceylon, Philippines, Australia, Lord Howe Island, New Caledonia.

Barbella Stevensii (Ren. & Card.) Fleisch.

Sin Lum Kaba, no. *112.*

Distribution: Sikkim.

Barbella pendula (Sull.) Fleisch.

Mong Yang, Kengtung State, epiphytic, 3500 ft., no. *9860.*

Distribution: Ceylon, Sumatra, Java, China, Japan, Formosa, Philippines, Southern United States.

Barbella (Aerobryella) **burmensis** Bartr. sp. nov.

Tenella, lutescens, nitida. Caules secundarii elongati, tenues, flexuosi, remote ramosi, ramis brevibus, vix 1 cm. longis, complanatis, obtusis. Folia caulina ovato-lanceolata, acuminata, 1.3 mm. longa; margines plani, ubique denticulati; costa valida, supra medium folii evanida; cellulae lineares, unipapillati; folia ramea subsimilia, breviter acuminata, ad 1.8 mm. longa, 0.6 mm. lata, margines fortiter denticulati. Caetera ignota.

Haka, mossy forest, 7625 ft., no. *7500d,* **type.**

The branch leaves in this species are broader and shorter than in *B. javanica* (Bryol. Jav.) Broth. and smaller and more crowded than in *B. spiculata* (Mitt.) Broth.

Meteoriopsis ancistrodes (Ren. & Card.) Broth.

Mt. Popa, on trees, 4000 ft., no. *6616*.

Distribution: Himalayas, Formosa.

Meteoriopsis squarrosa (Hook.) Fleisch.

Pang Yang, Manglon State, epiphyte, 5000 ft., no. *9818.1;* Namkham, no. *121*.

Distribution: Himalayas, Ceylon, Malay Peninsula, Siam, Sumatra, Java, Philippines.

Meteoriopsis reclinata (Mitt.) Fleisch.

Taunggyi, F.S.S., on trees, 4500 ft., no. *9499;* Pang Yang, Manglon State, epiphyte, 5000 ft., no. *9661, 9664;* Mong Yang, Kengtung State, epiphyte, 3500 ft., no. *9861-B, 9873*.

Distribution: Nilghiri, Ceylon, Java, Celebes, Philippines, Formosa.

NECKERACEAE

Calyptothecium burmense Bartr. sp. nov.

Caulis secundarius ad 7 cm. longus, cum foliis 5-6 mm. latus, parcissime ramosus, valde complanatus, luteo-viridis, nitidus. Folia fortiter complanata, horride patula, haud undulata, vix auriculata, concava, oblongo-ovata, breviter acuminata, ca. 3.5 mm. longa, 1.5 mm. lata, inferiora minora; margines erecti, superne denticulati; costa supra medium folii evanida; cellulae anguste rhomboideae, 7–8 μ latae, ca. 1 : 7, parietibus firmis, pellucidis, infimae laxiores, fuscae. Caetera ignota.

Pang Yang, Manglon State, epiphyte, 5000 ft., no. *9803-B* **type,** *9819*.

In this species the stems are more strongly flattened and less branched than in *C. Ramosii* Broth. of the Philippines, the leaves are broader and the lamina cells wider. No. *9819* shows the leaves more or less auriculate and has scattered septate propagula in the upper leaf axils but otherwise agrees with the type collection.

Calyptothecium himantocladioides Bartr.

Mt. Nwalabo, Tavoy, on rocks, 5000 ft., no. *8195*.

Distribution: Philippines.

Calyptothecium Urvilleanum (C. M.) Broth.

Haka, on trees, 7400 ft., no. *7448;* Burma-Tibet Frontier, Valley of Tamai River, 3000 ft., *F. Kingdon Ward*, Coll., Jan. 1931.

Distribution: India, Malaysia, to Fiji, Caroline Islands, Samoa and Tahiti.

Neckera crenulata Harv.

Taungteik (Falam), open mountain side, 5000 ft., no. *7265;* Pang Yang, Manglon State, 5500 ft., no. *9690-B*.

Distribution: Himalayas, Khasia.

Neckera himalayana Mitt.

Haka, mossy forest, epiphyte, 7625 ft., no. *7502*.

Distribution: Sikkim.

Homaliodendron exiguum (Bryol. Jav.) Fleisch.

Pang Yang, Manglon State, 5500 ft., no. *9687.*

Distribution: Himalayas, Ceylon, Malay Peninsula, Sumatra, Java, Celebes, Philippines, Australia, New Guinea.

Homaliodendron microdendron (Mont.) Fleisch.

Haka, mossy forest, 7625 ft., no. *7500c.*

Distribution: Sikkim, Khasia, Bhotan, Yunnan, Borneo, Philippines, Formosa.

Homaliodendron flabellatum (Sm.) Fleisch.

Loi Naing, Sampu, Namkhok State, epiphytic in mossy forest, 7500 ft., no. *8355;* Sin Lum Kaba, no. *110.* Haka, mossy forest, 7625 ft., no. *7500b.*

Distribution: India and Ceylon to Malaysia and Japan and through the Pacific Islands to Hawaii.

Thamnium subseriatum (Hook.) Mitt.

Haka, mossy forest, 7625 ft., no. *7499, 7500.*

Distribution: Himalayas, Ceylon, Philippines.

THUIDIACEAE

Claopodium nervosum (Harv.) Fleisch.

Mt. Popa, damp places, 3000 ft., no. *6632;* Taunggyi, F.S.S., on damp ground, 5000 ft., no. *8781.1.*

Distribution: Himalayas, Ceylon, Sumatra, Java, Celebes, Philippines, China, Korea, Japan.

Thuidium investe (Mitt.) Jaeg.

Ah-Shai-Myin, Ah-Naught-Myin, Lawk-Sawk State, no. *8701-A.*

Distribution: Philippines.

Thuidium tamariscellum (C. Müll.) Bryol. Jav.

Taunggyi, F.S.S., on damp ground, 4500 ft., no. *9070, 9085.*

Distribution: Nilghiri, Tonkin, Siam, Java, Philippines.

Thuidium Meyenianum (Hampe) Bryol. Jav.

Gotiek, on rocks, 2800 ft., no. *9524;* Naungkhio, Hsipau, on rocks, 2800 ft., no. *9535;* Pang Yang, Manglon State, epiphyte, 5000 ft., no. *9674.*

Distribution: Himalayas, Ceylon, Annam, Philippines, Sumatra, Java, New Guinea, Solomon Islands.

Thuidium glaucinoides Broth.

Mong Yang, Kengtung State, damp bank, 3500 ft., no. *9865.*

Distribution: Tonkin, Malaysia, China, Formosa, Philippines, New Hebrides, Fiji, Samoa.

Thuidium cymbifolium (Doz. & Molk.) Bryol. Jav.

Pang Yang, Manglon State, epiphyte, 5000 ft., no. *9803-A;* Taungteik (Falam), open mountain side, 5000 ft., no. *7263;* Haka, mossy forest, 7625 ft., no. *7498;* Mt. Popa, epiphyte and on banks, 3500 ft., no. *6630;* Pang Wai, Kengtung State, 6000 ft., no. *9699;* Sin Lum Kaba, no. *116.* Burma-Tibet Frontier, *F. Kingdon Ward,* 1930–31.

Distribution: wide in Malaysia, Formosa, Philippines, Lord Howe Island, New Guinea, China, Japan.

Actinothuidium Hookeri (Mitt.) Broth.

Mt. Victoria, 10000 ft., on tree, no. *8531.*

BRACHYTHECIACEAE

Brachythecium Buchanani (Hook.) Par.

Taunggyi, F.S.S., on trees, rocks, and ground, 4500–5000 ft., no. *8773.1, 8781, 9081, 9090;* Pang Wai, Kengtung State, 6000 ft., no. *9695-B;* Nataung, Kareni State, no. *9426-B;* Mt. Popa, Myin Gyan, on rocks, 3000 ft., no. *6632;* Sin Khoa (Haka), on tree trunks, 4000 ft., no. *7617;* Sin Lum Kaba, no. *120.*

Distribution: Himalayas, Assam, Philippines, China, Japan.

The above collections are all sterile but probably belong here.

Brachythecium longicuspidatum (Mitt.) Jaeg.

Zokhua (Haka), 4800 ft., no. *7490a.*

Distribution: Sikkim.

ENTODONTACEAE

Erythrodontium julaceum (Hook.) Par.

Taunggyi, F.S.S., on rocks, trees and banks, 4500–5200 ft., no. *8792, 9061, 9064, 9068, 9084, 9091, 9092, 9090.1, 9507-B;* Namkok, on tree, 3000 ft., no. *9400.*

Distribution: India, Assam, Tonkin, Yunnan, Ceylon, Sumatra, Java, Celebes, Philippines.

Trachyphyllum inflexum (Harv.) Gepp

Naunghkio, Hsipaw State, on tree trunk, 2800 ft., no. *9574* in part.

Distribution: India, Philippines, New Caledonia.

Campylodontium flavescens (Hook.) Bryol. Jav.

Pang Yang, Manglon State, epiphyte, 5000 ft., no. *9817.*

Distribution: India, Malay Peninsula, Ceylon, Annam, Sumatra, Java, Philippines, Celebes, Australia.

Rozea pterogonioides (Hook.) Jaeg.

Mt. Victoria, Chin Hills, on trees, 10000 ft., no. *8540.*

Himalayas, Yunnan.

Entodon flavescens (Schwaegr.) Jaeg.

Taunggyi, F.S.S., on trees, 4500 ft., no. *9098*.

Distribution: Nepal.

Much more slender than the plant illustrated in Schwaegrichen's plate but apparently not specifically distinct.

Entodon plicatus C. Müll.

Pang Yang, Manglon State, epiphyte, 4500–6000 ft., no. *9659-B*, *9665*, *9672*, *9712;* Mong Yang, Kengtung State, epiphyte and on soil, 3500 ft., *9861-a*, *9871-A*, *9871-B*, *9872.1;* Taunggyi, F.S.S., on trees, 4500 ft., no. *8780-A*, *9095;* Hopong, Hopong State, no. *8276a;* Naungkhio, Thibaw, on rocks, 2800 ft., no. *9540.1;* Zokhua (Haka), 4800 ft., dry banks, no. *7490*.

Distribution: Himalayas, Ceylon, Celebes, Philippines.

PLAGIOTHECIACEAE

Stereophyllum tavoyense (Hook.) Jaeg.

Mt. Popa, on rocks, 3000 ft., no. *6654* in part; Mt. Popa, 4000 ft., no. *106*.

Distribution: India.

SEMATOPHYLLACEAE

Clastobryum Dickasonii Bartr. sp. nov.

Dioicum? gracile, lutescenti-viride, nitidum. Caulis repens, irregulariter subpinnatus, ramis brevibus, ad 6–7 mm. longis, caudato-attenuatis. Folia erecto-patentia, oblongo-lanceolata, 1.2 mm. longa, 0.4 mm. lata, acuminata, integerrima, fortiter concava, ecostata; cellulae lineares, haud incrassatae, ca. 1 : 8, laevissimae, infimae fuscae, alares 3–4, magnae, oblongae. Fructus ignotus.

Saw Chaung, Chin Hills, on tree, 6000 ft., no. *8556a*, **type.**

In this species the leaves are relatively broader and shorter acuminate than in *C. caudatum* (Bryol. Jav.) Fleisch. of Java, the cells are shorter and not incrassate and the reduced leaves of the caudate tips are short acuminate. *C. caudiforme* Dix. of India is described as having strongly denticulate leaves and very narrow cells.

Acanthocladium baculiferum Dix.

Nataung, Kareni State, open damp ground, 5000 ft., no. *9422-A;* Nataung, Koreni State, on trees, shady slope, 5000 ft., no. *9428;* Nataung, Kareni State, on trees, shady forest, 5300 ft., no. *9445;* Pang Yang, Manglon State, on a rock, 5500 ft., no. *9813-B*, *9814-B;* Mong Pawk, Kengtung State, epiphytic and on ground in woods, 4000 ft., no. *9824.1*, *9825*.

Distribution: Assam.

As no. *9428* and *9445* in the above series are in fruit it is possible to add to the original description of this interesting species, previously known only from Assam, the following sporophyte characters. Perichaetial leaves erect, not strongly convolute, the inner lightly plicate,

oblong-ovate, rather abruptly acuminate, denticulate toward the extreme apex. Seta slender, smooth, reddish, strongly flexuose, to 3.5 cm. long. Capsule nodding, strongly asymmetrical, constricted under the oblique mouth when dry, urn about 2 mm. long, brown, gibbous on the upper side, abruptly constricted to a short neck. Peristome normal. Lid and calyptra not seen.

Acanthocladium benguetense Broth. var. **latifolium** Bartr. var. nov.

Ramis vix attenuatis. Folia caulina latiora, ad 0.75 mm. lata, abrupte acuminata, subintegra.

Nataung, Kareni State, on tree, shady forest, 5300 ft., no. *9444*, **type.**

Although the differences between the Burma plants and those of the Philippines are quite marked the distinctions seem hardly wide enough to merit a new species. The Burma plant is more robust than the type from the Philippines and the branchlets are scarcely attenuate; the stem leaves are more broadly ovate, more abruptly acuminate and subentire.

Brotherella erythrocaulis (Mitt.) Fleisch.

Burma-Tibet Frontier, Adung Valley, uppermost Abies-Rhododendron forest, *F. Kingdon Ward*, 1930–31.

Distribution: Sikkim, Bhotan, Yunnan.

Sematophyllum tristichulum (Mitt.) Fleisch.

Pang Yang, Manglon State, rock, 5000 ft., no. *9822*.

Distribution: Khasia, Assam, Ceylon, Siam, Java, Annam, Philippines.

Sematophyllum subhumile (C. Müll.) Fleisch.

Pang Yang, Manglon State, damp soil, 5000 ft., no. *9659-A.1*.

Distribution: India.

Taxithelium nepalense (Schwaegr.) Broth.

Rangoon, Royal Lake, on damp earth, 40 ft., no. *8667*.

Distribution: India, Ceylon, Sumatra, Java, Assam, Borneo, Philippines, Amboina.

HYPNACEAE

Hypnum plumaeformé Wils.

Mong Yang, Kengtung State, epiphyte and on damp soil, 3500 ft., no. *9863-A, 9863-B, 9866, 9870;* Pang Yang, Manglon State, epiphyte, 5000 ft., no. *9645*.

Distribution: Korea, Japan, China, Formosa, Tonkin.

Ectropothecium dealbatum (Hornsch. & Reinw.) Jaeg.

Taunggyi, F.S.S., on tree, 5000 ft., no. *8780-A-1*.

Distribution: Sumatra, Java, Borneo, Philippines.

Isopterygium Textori (Lac.) Mitt.

Wunba Taung, Chin Hill, no. *8482-A.*

Distribution: South India, Malay Peninsula, Annam, Borneo, Philippines, Formosa, China, Japan.

Isopterygium albescens (Schwaegr.) Jaeg.

Tavoy (18 miles down), on trees, 1000 ft., no. *8012* in part.

Distribution: Himalayas, Sumatra, Java, Borneo, Philippines, Celebes, Pacific islands to Hawaii.

Ptilium crista-castrensis (Hedw.) DeNot.

Burma-Tibet frontier, Adung Valley, 12000 ft., *F. Kingdon Ward,* 1930–31.

Distribution: Europe, North America, Japan, Yunnan, Sikkim, Caucasus.

HYLOCOMIACEAE

Leptohymenium tenue (Hook.) Schwaegr.

Nataung, Kareni State, on trees, shady slope, 5000–6300 ft., no. *9429, 9446.2;* Pang Yang, Manglon State, on trees, 5000–5500 ft., no. *9642-A.1, 9644;* Falam-Haka, banks along paths, 6000 ft., no. *7292;* Haka, mossy forest, epiphytic in shade, 7625 ft., no. *7501;* Burma, without locality, no. *7427-A.*

Distribution: North India, Khasia, Philippines.

Foreauella orthothecia (Schwaegr.) Dix.

Taunggyi, F.S.S., epiphytic, damp ground, and on dry slope, 4500 ft., no. *9060, 9067, 9498;* Mong Yang, Kengtung State, epiphyte, 3500 ft., no. *9872;* Naungkhio, Thibaw, on rocks, 2800 ft., no. *9540;* Mt. Popa, 4000 ft., no. *105;* N'Bapa, no. *107.*

Distribution: Himalayas, South India, Siam, Philippines.

Macrothamnium macrocarpum (Hornsch. & Reinw.) Fleisch.

Ah-Shai-Hymin, Ah-Naught, Hymin Lawk Sawk State, on tree, 7600 ft., no. *8647,* a slender form; Mt. Victoria, no. *8531-A;* Taungteik (Falam), mountain path side, 5000 ft., no. *7258;* Haka, on rocks and trees, 6200 ft., no. *7701;* Taunggyi, F.S.S., open damp ground and on trees, 4500–5500 ft., no. *8102, 8773, 9076, 9082, 9087;* Pang Yang, Manglon State, epiphyte, 5000 ft., no. *9646,* slender form.

Distribution: East India, Ceylon, Sumatra, Java, Borneo, Philippines, Hawaii.

Macrothamnium submacrocarpum (Hampe) Fleisch.

Haka, mossy forest, epiphytic, shady, 7625 ft., no. *7497.*

Distribution: Himalayas, Khasia.

POLYTRICHACEAE

Atrichum flavisetum Mitt.

Taunggyi, F.S.S., damp ground and rocks, 4500–5000 ft., no. *9065, 9080.1, 9093.*

Distribution: Himalayas, Philippines, Japan.

Atrichum undulatum (Bry. Eur.) Limp.

Taunggyi, F.S.S., on damp ground and rocks, 5000 ft., no. *8782, 9359.*

Distribution: wide in north temperate zone, Japan, China, Cochinchina.

Pogonatum Junghuhnianum (Doz. & Molk.) Bryol. Jav.

Taunggyi, F.S.S., on damp ground, 4500 ft., no. *9074, 9077, 9080, 9086;* Nataung, Kareni State, damp open slope, 5000 ft., no. *9420.*

Distribution: Sikkim, Siam, Java, Celebes, Borneo, Philippines.

Pogonatum inflexum Lindb.

Mt. Victoria, Chin Hills, on rock, 5000 ft., no. *8511;* Thandaung, Taungoo, on rocks and damp places, 3400–4500 ft., no. *6730, 8167;* Taungteik, (Falam), open mountain side, 5000 ft., no. *7264;* Mt. Nwalabo, Tavoy, on rocks and shady dry slope, 5000 ft., no. *8203-A, 8204;* Zokhua (Haka), banks, 4800 ft., no. *7687.A;* Pang Yang, Manglon State, epiphyte, 5000–5500 ft., no. *9655, 9689.1.*

Distribution: Japan, Formosa, China, Siam.

Pogonatum gymnophyllum Mitt.

Haka, mossy forest, 7600 ft., no. *7577.*

Distribution: Himalayas, China, Tonkin, Formosa, Philippines, Celebes.

Pogonatum microstomum (R. Br.) Brid.

Wunba Taung, Chin Hill, on rocks, 7900 ft., no. *8482;* Webula, along the path where there is damp and shade, no. *7785;* Taungteik (Falam), damp banks, 4500 ft., no. *7549.*

Distribution: Himalayas, Khasia, Nilghiri, Ceylon, West China, Philippines.

Polytrichum xanthopilum Wils.

Burma-Tibet Frontier, Adung Valley, 12000 ft., *F. Kingdon Ward,* Coll.

Distribution: Sikkim.

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ADDITIONS TO THE MOSS FLORA OF NORTHERN CHILE[1]

Edwin B. Bartram

Only ten species are represented in the collections made by Dr. Ivan M. Johnston in the montane and coastal regions of northern Chile during late 1925 and early 1926 yet the series is an unusually instructive one. The following list includes two new species and four records new to Chile, as far as my knowledge goes. The types of the new species are in my herbarium and duplicates are in the Farlow Herbarium, Harvard University.

POTTIACEAE

Barbula replicata Tayl.

Antofagasta Province, Dept. Taltal, Aguada Panulcito, along trail to the old Andacolla Mine, on slopes above water hole, circa lat. 24° 49′ S. On earth on dryish cliff wet only by occasional fog, near waterhole, Dec. 5, 1925, *I. M. Johnston, 16* in part.

Pottia flavipes Mont.

Atacama Province, Dept. Copiapo, head of Quebrada de San Miguel, lat. 27° 25′ S., long. 69° 36′, in very alkaline vega in dry quebrada, grows where soil is white with alkali, Sierra San Miguel, alt. circa 2700 m., Nov. 8, 1925, *I. M. Johnston, 2.* — Atacama Province, Dept. Copiapo, Quebrada de San Miguel above Los Marayes, lat. 27° 28′ S., long. 69° 43′, along slow streamlet in vega, Sierra San Miguel, alt. circa 1500 m., Nov. 7, 1925, *I. M. Johnston, 8.* — Atacama Province, Dept. Copiapo, head of Quebrada de San Miguel, lat. 27° 23′ S., long. 69° 33′, uppermost vega, bleak, Sierra San Miguel, alt. circa 3800 m., Nov. 8, 1925, *I. M. Johnston, 9.* — Atacama Province, Dept. Copiapo, between Portezuelo Tolar and Carrizalillito, in small slightly alkaline vega, lat. 27° 37′ S., long. 69° 42′, alt. circa 3000 m., Nov. 9, 1925, *I. M. Johnston, 22.* — Atacama Province, Dept. Copiapo, Quebrada Tolar, lat. 27° 34′ S., long. 69° 42′, uppermost vega, Sierra San Miguel, alt. circa 3600 m., *I. M. Johnston, 7.* — Atacama Province, Dept. Vallenar, vicinity of Laguna Valeriano, circa lat. 29° 3′ S., long. 69° 52′ W., common in vega at head of lake, alt. circa 4000 m., Jan. 8–10, 1926, *I. M. Johnston, 23.* — Atacama Province, Dept. Copiapo, Sierra San Miguel, Vega de San Pedrito, lat. 27° 22′ S., long. 69° 45′ W., in slightly alkaline vega, alt. circa 3000 m., Nov. 5, 1925, *I. M. Johnston, 3.* — Atacama Province, Dept. Copiapo, Sierra San Miguel, Aguada del Tobaco, lat. 27° 23′ S., long. 69° 46′ W., in vega, alt. circa 3000 m., Nov. 6, 1925, *I. M. Johnston, 13.* — Atacama Province, Dept. Copiapo, Quebrada de Paipote, Pasto Grande, in slightly alkaline vega, alt. circa 2500 m., *I. M. Johnston, 14.* — Northern Argentina: Andes of northwestern San Juan, headwaters of Rio de la Tagua,

[1] Contribution from the Laboratories of Cryptogamic Botany and the Farlow Herbarium, Harvard University, no. 173.

circa lat. 29° 25/35′ S., long. 69° 50/55′ W., bleak meadow, in wet places only, circa 4000 m. alt., *I. M. Johnston, 15.*

I am tempted to believe that *Pottia flavipes* is a valid species well distinguished from *P. Heimii* (Hedw.) by the golden yellow setae and nearly or quite smooth leaf cells. Typical *P. Heimii* is well represented in Fuegia but the above series is so obviously different, even to the naked eye, that it seems unwise to combine them in one specific concept. The dentation of the leaves, the length of the setae and the shape of the capsules are all unstable and variable characters of relatively little diagnostic importance.

Crossidium Roseae (Williams) comb. nov.

Pterogoneurum Roseae Williams, Bull. Torrey Bot. Club **42**: 394. 1915.

Antofagasta Province, Dept. Taltal, Aguada Panulcito, along trail to old Andacolla Mine, on slopes above waterhole, circa lat. 24° 49′ S., on earth on dryish cliff wet only by an occasional fog, near waterhole, Dec. 5, 1925. — *I. M. Johnston, 16* in part.

New to Chile. These plants are identical with the original collection from Peru. The costa is not lamellose on the inner face but covered with filaments 4–5 cells high with the end cell larger, entire and conical. This structure suggests that the species should be placed in *Crossidium.*

BRYACEAE

Bryum megalothecium Thér.

Antofagasta Province, Dept. Taltal, Aguada del Panul, circa lat. 24° 47′ S., on cliff wet by streamlet at springs, Dec. 4, 1925, *I. M. Johnston, 5.* — Antofagasta Province, Dept. Taltal, vicinity of Aguada del Migual Diaz, circa lat. 24° 35′ S., moist soil under rock near waterhole, Dec. 1–4, 1925, *I. M. Johnston, 10.*

Bryum flexisetum Mitt.

Atacama Province, Dept. Vallenar, vicinity of Laguna Valeriano, Jan. 8–10, 1926, *I. M. Johnston, 28.*

New to Chile.

ORTHOTRICHACEAE

Orthotrichum Johnstoni Bartr. sp. nov. FIG. 1–5.

Autoicum, laxe caespitosum, caespitibus fuscescenti-viridibus. Caulis flexuoso-erectus, ad 3 cm. altus, ramosus. Folia sicca laxe adpressa, humida patentia, 5–6 mm. longa, anguste lanceolata, acuminata; marginibus inferne anguste recurvis, superne planis, integris; costa infra summum apicem evanida; cellulae superiores majus incrassatae, valde pluri-papillosae, basilares lineares, laevissimae. Theca immersa, sicca plicata, stomata superficialia; exostomii dentes sicca recurvi, processus endostomii 16, anguste lineares; calyptra sparse pilosa; spori 18–24 μ.

This species has a superficial resemblance to some of the North American forms of *O. Lyellii* Hook. & Tayl. but is thoroughly distinctive in the

autoicous inflorescence and the longer peristome. Vicinity of Agua Grande ("Cachinal de la Costa" of Philippi) near Antofagasta — Atacama provincial boundary, circa lat. 26° 2′ S., on bushes on flat just back of high fog-bathed sea cliffs, Dec. 16–18, 1925, *I. M. Johnston, 17*, **type.**

FABRONIACEAE

Juratzkea seminervis (Kunz.) Lor.

Antofagasta Province, Dept. Taltal, El Rincon, just north of Paposo, along trail to old Paranas Mine, circa lat. 24° 59′ S., under low bushes on rich fog-drenched ridge in fertile belt, circa 400 m., Dec. 7, 1925, *I. M. Johnston, 6.*

AMBLYSTEGIACEAE

Hygroamblystegium austro-fluviatile (C. Müll.) Broth.

Atacama Province, Dept. Chanaral, vicinity of Potrerillos, circa lat. 26° 27′ S., long. 69° 30′ W., in cold, bleak meadow, slightly alkaline, Aguada Pelada, alt. circa 3600 m., Oct. 24, 1925, *I. M. Johnston, 19.*

This determination is based on a specimen from Chile named by Thériot. I have not seen the original of *Hypnum austro-fluviatile* C. Müll. from South Georgia. The entire leaf margins and the less sharply defined area of inflated cells in the decurrent auricles will distinguish these plants from *Cratoneuron filicinum* (Hedw.) to which they bear a close superficial resemblance.

Hygroamblystegium crassicostatum Bartr. sp. nov. FIG. 6–8.

Dioicum? Caules elongati, ramosi, rigidi, fluitantes. Folia erecta, adpressa, ovata, acuminata, ad 1.5 mm. longa; marginibus planis, ubique minutissime denticulatis; costa pervalida, 100–120 μ lata, percurrens; cellulae hexagonae, plus minus elongatae, basilares subrectangulares, infimae laxiores. Caetera ignota.

I feel but little hesitation in referring this collection to *Hygroamblystegium*. The species is unique in the Chilean flora but seems to be closely allied to *H. irriguum* (Wils.) Loeske var. *spinifolium* (Schp.) Grout of North America from which it may be sharply distinguished by the rigidly erect leaves and the very strong percurrent costa uniform in width to near the apex.

Atacama Province, Dept. Copiapo, Quebrada del Mono at forks below Mina Maricunga, lat. 27° 5′ S., long. 69° 27′ W., in water in vega, alt. circa 3000 m., Quebrada de Paipote, *I. M. Johnston, 20*, **type.** — Atacama Province, Dept. Copiapo, Quebrada de Cerro Bravo at Incaguasi, lat. 25° 42′ S., long. 69° 20′ W., in pool in bleak vega, 2 cm. of ice broken in collecting this at 8 A. M., Nov. 1926, *I. M. Johnston, 1.*

Hygrohypnum peruviense Williams

Atacama Province, Dept. Vallenar, vicinity of Laguna Valeriano, circa lat. 29° 3′ S., long. 69° 52′ W., in water in cold vega at head of lake, alt. circa 4000 m., Jan. 8–10, 1926, *I. M. Johnston, 4.*

New to Chile. Although not identical with the type material I think this collection may safely be referred here. The leaves are smaller, strongly falcate-secund, hooked at the tips of the branches and more slenderly acuminate but otherwise closely similar in areolation and costal structure.

BUSHKILL
PIKE CO., PENNA.

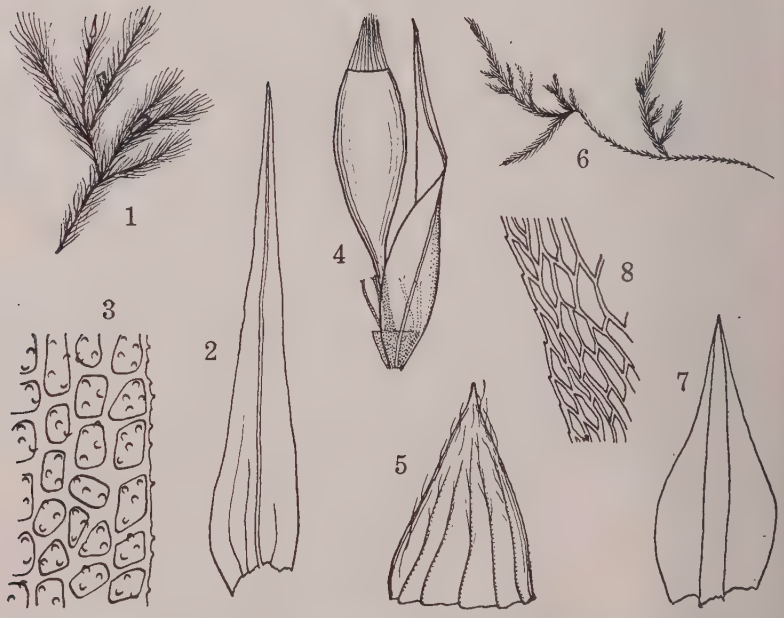

Fig. 1–5, *Orthotrichum Johnstoni* Bartr. **1,** Moist plant × 1.4. **2,** Leaf × 14. **3,** Upper leaf cells and margin × 315. **4,** Moist capsule × 14. **5,** Calyptra × 14. **Fig. 6–8,** *Hygroamblystegium crassicostatum* Bartr. **6,** Plant × 1.4. **7,** Leaf × 25.2. **8,** Upper leaf cells and margin × 315.

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THE SEXUAL DIMORPHISM OF THE TROPICAL MOSSES OF THE GENUS MACROMITRIUM

Marthe Ernst-Schwarzenbach

Sexual dimorphism occurs in several mosses but its expression is particularly clear in the genus *Macromitrium* which grows in the tropics of the Old and the New World. In 1920 Max Fleischer (Ber. Deut. Bot. Gesell. **38**) noted that the spores of the dioecious species are of unequal size while those of the monoecious ones are of equal size. He found that the dioecious plants had dwarf male plants living on the leaves of the normal large female ones. The dwarf males arose from germinating spores that had fallen on the leaves. He looked for a relation between sex and spore dimorphism and believed erroneously, as will shortly be demonstrated, that the dwarf males resulted from the germination of the big spores.

The following questions now need to be discussed in the light of new experiments:[1] 1) How do distribution of the sexes, and dimorphism behave in a larger number of species of different origin? 2) Is the determination of sex genotypic or phaenotypic? 3) Is the difference in size of the spores an expression of sexual dimorphism?

Statistical investigations on the variation of the spores have been carried out with herbarium material of thirty-nine species from Java, India, Ceylon, Japan, Australia, the islands of the Pacific, Africa, Central and South America. The specimens have also been examined for dwarf males, and male and female gametangia. The ten monoecious species that were investigated proved to be homosporous, the measurements of their spores gave the results graphically represented in figure 1 which is characterized by having a single peak. Twenty-seven dioecious species produced normal sized female plants and epiphytic dwarf males, seven of them were homosporous and twenty were more or less distinctly heterosporous as shown in figure 2 which clearly shows the two peaks. Thus it can be said that in the dioecious species dimorphism of the stems is always clearly evident while spores are mostly but not always dimorphous. *Macromitrium Blumei* has a special position in that its spores are not distinctly heterosporous since, as is shown in figure 3, there are not two definite peaks. According to Denning, it is polyoical, i. e. it has partly dimorphic dioecious and partly normal sized monoecious plants.

The study of the development of the spores of a heterosporous species from Java has shown that the spore-mother-cells first produce all spores of an equal size. They soon escape from the tetrad formation and later

[1] Vide M. Ernst-Schwarzenbach: Zur Kenntnis des sexuellen Dimorphismus der Laubmoose, — Arch. der Julius Klaus-Stiftung Zürich **14**, 1939; — Weitere Mitteilungen über den sexuellen Dimorphismus der tropischen Laubmoosgattung *Macromitrium*. 2. Jahresber. Schweiz. Gesell. f. Vererbungforsch. Arch. der Julius Klaus-Stiftung Zürich **17**, 1942.

the differentiation begins and results in big and small spores whose relation to a tetrad cannot be seen. The ratio of big to small spores is about 1:1.

The relation of spore dimorphism and sexual determination is of special interest and can only be ascertained by culture experiments. With material from Java, especially *M. salakanum,* one-spore cultures could be made in hanging drops of nutritive solution. The big as well as the small spores germinated well. On the protonemata of the small spores, dwarf males grew in two to three months and produced ripe antheridia about two months later. The cultures remained alive for about one and one-half years, exceptionally three and a half years, repeatedly forming new secondary protonemata with dwarf males on each. Thus the possibility that an early male phase is followed later by a female phase is excluded and the genotypical method of male determination of the small spores is evident.

The products of the germination of the large spores gave considerable trouble. The protonemata from the big spores also produce small stems but these soon differ from the dwarfs by their attenuate appearance (Fig. 5). They are much less numerous and grow much more slowly than the dwarfs, but eventually they are quite similar to the females grown under natural conditions.

The greatest difficulties were encountered in raising the plants that originated from the big spores to the fertile state. Only in one culture did several plants bear numerous archegonia. Similarly, the *Macromitrium* tufts from the natural habitats, cultured at Zürich for four years, very seldom formed archegonia and sporogonia. Therefore the evidence that the normal-sized plants are really female-determinate had to be obtained by another method: by the regeneration of leaves, since if the leaves of the big female plants constantly give big plants, these are genotypically female-determinate, whereas if they also give stems with antheridia, they are genotypically monoecious. The result of the cultures was very clear: the leaves of big female plants produced protonemata which always gave rise again only to big plants of normal size. Thus it is evident that genotypical sex determination of *M. salakanum* is bound to sexual dimorphism.

The expression of sexual dimorphism of *M. salakanum* is different during its development since in the spores there is a difference in size and in color: the female-determinate spores, of a mean diameter of 36.57 μ, are green, while the male-determinate spores, of a mean diameter of 19.60 μ, are yellow. The primary protonema growing from the spore depends so much on the environment that no dimorphism can be observed. It is only later on when the young stems form new secondary protonemata that dimorphism is noticeable again: the female has more the appearance of rhizoids while the male resembles chloronema.

The most distinct morphological and physiological dimorphism is

found in the moss stems: the dwarfs are ½–1 mm. high, the orthotrope parts of the female stems are 2–3 mm. The length of the leaves of the male is 0.30–0.45 mm. and that of the female leaves is 1.5–2.5 mm.

The size of an organ is generally determined by the size and number of the cells. Measurements have shown that the differences in the organs of *M. salakanum* are not dependent on the cell size because it is never smaller, perhaps even larger, in the males than in the female. The size of the organs is determined by the cell number: in the leaves of the dwarfs, their mean number in length is 33.5, and in width 23.2 whereas the female leaves are 204 cells in length and 74.7 cells in width. Therefore the number of the cells in the male plant is only a small part of the number in the female.

SUMMARY

The dioecious species always have dwarf male individuals which are the only ones to produce antheridia. If the normal sized stems, or the regeneration of their leaves, produce sexual organs, they are archegonia. Not all but many of the dioecious species show dimorphism in the spores, heterospory, whilst the monoecious are always homosporous. Species of *Macromitrium* from Java have shown their dimorphism to be determined genotypically. The small spores give dwarf males and the large spores produce large female plants. Sexual dimorphism is expressed in the spores, secondary protonema, and stems. The difference in the size of the organs depends on the number of cells per organ.

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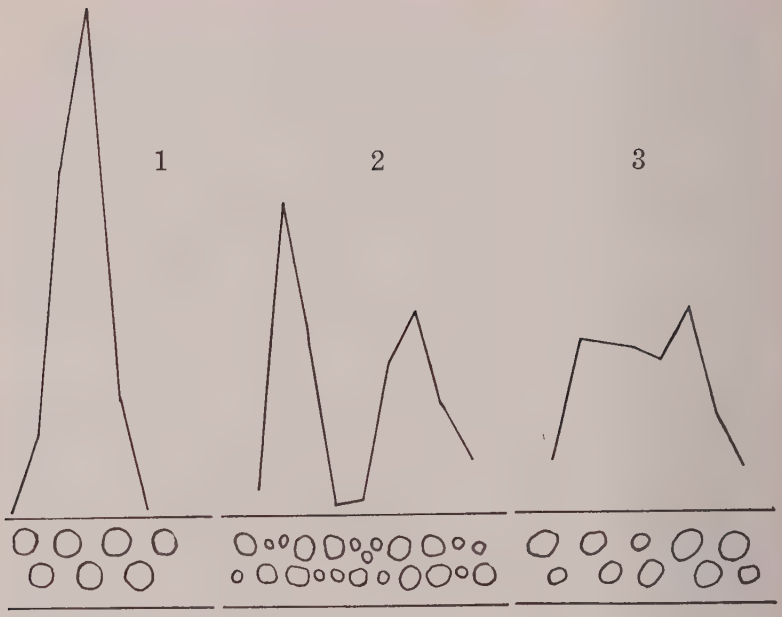

Fig. 1. Diagram showing size vs. distribution of the homosporous species, *Macromitrium Reinwardti*. **Fig. 2.** Diagram showing size vs. distribution of the heterosporous species, *Macromitrium salakanum*. **Fig. 3.** Diagram showing size vs. distribution of the indistinctly heterosporous species, *Macromitrium Blumei*. **Fig. 4.** Male dwarf on the leaf of a female plant from Java. **Fig. 5. a.** Dwarf male plants, and **b.** Female plants from cultures of the same age, and drawn to the same magnification ($\times$ 22.4).

1(2): 199–244 FARLOWIA July, 1943

THE MORPHOLOGY, TAXONOMY, AND DISTRIBUTION OF COCCIDIOIDES IMMITIS RIXFORD AND GILCHRIST 1896 [1]

E. E. Baker, E. M. Mrak, and C. E. Smith [2]

The fungus, *Coccidioides immitis* Rixford and Gilchrist 1896, is the causative agent of a disease, coccidioidomycosis (Dickson, 1937a), having two principal clinical manifestations, namely: an acute pulmonary infection which is sometimes accompanied by erythema nodosum, and usually heals spontaneously, and a generalized infection, coccidioidal granuloma, which frequently terminates fatally. When the generalized infection occurs, it is nearly always as a dissemination from a preceding primary pulmonary infection.

The first case of coccidioidal granuloma was described by Posadas (1892, 1900) and Wernicke (1892). They described the morphology of the parasite in human tissues in considerable detail. Rixford and Gilchrist (1896) gave a more complete morphological description of the parasitic phase of *C. immitis* in their study of the first two North American cases. Ophüls and Moffitt (1900) isolated a white fungus from their patient, the third North American case of coccidioidal granuloma to be reported. They proved the etiological relationship of the fungus and gave a brief description of both the parasitic and cultural phases of the organism.

Ophüls (1905) gave the first complete description of *C. immitis*. He described in detail the formation of endospores by cleavage planes in animal tissues and the formation of chlamydospores in culture. Since Ophüls' description, numerous investigators have made many morphological studies, notably: Wolbach (1904), MacNeal and Taylor (1914), Fonseca and Area Leao (1927), Fonseca (1928), Ahlfeldt (1929), Almeida (1929, 1930a,b, 1932a,b,c, 1934a,b) Agostini (1932), Ciferri (1932), Moore (1932, 1938), Castellani and Jacono (1933), Takahashi (1933), Ota and Kawatsure (1933), Benham (1934), Ciferri and Redaelli (1936), Jordan and Weidman (1936) and Dickson (1937b). Most of these investigators have added little to Ophüls' description.

Ciferri and Redaelli (1934a,b, 1936) reported that if spherules of a certain strain were cultured semianaerobically by the technic of MacNeal and Taylor (1914), an isogamous or heterogamous copulation sometimes occurred prior to sporulation. This finding, however, lacks confirmation.

Lack (1938) devised a method for producing spherules from chlamydospores "in vitro." He incubated chlamydospores semianaerobically in a medium composed of glucose broth and partially coagulated egg albumin. Chlamydospores grown in this manner enlarged to form spherules rather than germ tubes as in ordinary cultures. Both semi-

[1] This investigation was supported by a grant from the Rosenberg Foundation.

[2] From the Department of Public Health and Preventive Medicine, Stanford University School of Medicine and the University of California.

anaerobiosis and partially coagulated egg albumin were essential to success.

Baker and Mrak (1941) reported that spherules (termed culture spherules) are formed by certain strains in old cultures, slide cultures and in a semi-solid medium containing 0.05% copper sulfate. They concluded that for these particular strains the culture spherules form a normal phase in the life cycle of the fungus.

Although a considerable number of papers have been published on the morphology and life history of *C. immitis*, the information is still incomplete. There has been no extensive comparison of strains isolated in widely separated areas. The taxonomy is confused because of the lack of morphologic information and the anomalous relationships of this organism. Furthermore, except for the paper of Ciferri and Redaelli (1936), published in Italian, there is no complete review of the literature concerning the morphology, taxonomy, and distribution of this organism.

The purpose of this investigation has been to compare morphologically fifteen strains of *C. immitis* secured from widely separated areas in order to obtain information of taxonomic significance and to obtain evidence regarding the systematic position of the fungus.

EXPERIMENTAL PROCEDURE

Fifteen strains of *C. immitis* representing isolates from various clinical types of coccidioidomycosis and various geographical locations were studied. The data concerning these cultures are tabulated in Table I.

Animal and culture inoculations were made with suspensions of chlamydospores and hyphal fragments in physiological saline solution. Each suspension was prepared by shaking a loopful of a month-old Sabouraud's glucose agar culture in 5 cc. of physiological saline solution. Experimental animals were usually inoculated with 0.5 cc. of suspension, a dose more than sufficient to insure infection.

The studies of the gross morphology were made on single-spore cultures obtained by the method of Hanson and Smith (1932), and the three media used were potato dextrose agar (see Rawlins, 1933), Sabouraud's glucose agar (see Lewis and Hopper, 1939), and a synthetic agar similar to a medium proposed by Stewart and Meyer (1932) except that the 1% ammonium chloride was reduced to 0.1%, and 2% agar was added.

All studies of the morphology in animal tissues (parasitic stages) were made on material obtained from mice or guinea pigs experimentally infected with cultures number 4 and 46. These cultures represented the typical and extreme forms under cultural conditions. However, all strains were inoculated into experimental animals and were found to be pathogenic and to present a uniform morphology even though some strains had been held in culture for several years. The mice, inoculated intraperitoneally, usually died the second week following inoculation. Guinea pigs, inoculated intratesticularly, were killed after three to four weeks. Fresh

material was examined by mounting pus or infected tissue fragments in cotton blue lacto-phenol (see Rawlins, 1933).

Tissues for cytological studies were fixed for 48 hours in the following fixatives: Bouin's solution, Allen's modification of Bouin's solution (PFA_3), Zenker's solution, Carnoy's solution, Karpachenko's solution, Flemming's strong solution, Flemming's strong solution diluted 1 : 2, Flemming's weak solution, 10% formalin in 0.85% sodium chloride solution, Müller's solution, and formalin-acetic acid-alcohol solution (formula number 2 of Rawlins, 1933). Sections 10 μ thick were used in most of the cytological studies. They were stained with Heidenhain's iron hematoxylin (schedule given by Rawlins, 1933, except that 0.5 instead of 2% hematoxylin solution was used), Flemming's triple stain, crystal violet, methylene blue, thionin, and Feulgen's stain. Usually no counterstain was used, although occasionally erythrosin or eosin was tried. Differential destaining was very difficult. In most cases the cytoplasm retained the basic nuclear stains as tenaciously as the nuclei. The best nuclear staining was obtained with tissue fixed in Flemming's strong solution diluted 1 : 2 followed by Flemming's triple stain.

Usually culture material was mounted in cotton blue lacto-phenol. Slide cultures were prepared by dipping slides, sterilized by immersion in alcohol followed by burning off the excess alcohol, into melted agar (usually potato dextrose agar). These agar-coated slides were then placed on bent glass rod supports in petri dishes containing a piece of sterile, moist blotting paper. After the agar solidified, a drop of spore suspension was placed on the slide. Finally the petri dishes were sealed with "parafilm" and stored at room temperature. After development, the excess agar on the bottom of the slide and around the culture was removed. The cultures were sometimes studied by adding a drop of cotton blue lacto-phenol and a cover slip. Other cultures were fixed in various fixatives, washed and after the excess agar was removed, dried, and stained. For staining the thallus, the slides were stained in 1% aqueous cotton blue with 1% acetic acid and destained slightly in acidified 95% alcohol to remove excess stain from the agar before dehydrating and mounting. Spore germination was studied in moist chamber slides.

Culture material for cytological observations was fixed for 48 hours in the following fixatives: Bouin's solution, Carnoy's solution, Zenker's solution, Flemming's strong solution diluted 1 : 2 or formalin-acetic acid-solution. The last was the most satisfactory. When other fixatives were used, differential destaining was not obtained. Numerous stains were tried but only iron hematoxylin gave satisfactory preparations. The nuclei of germinating spores were stained most satisfactorily in concentrated hematoxylin solution (2–4%) for about 5 minutes, followed by a short differentiation in 4% ferric alum. In contrast, the nuclei of mature mycelia and chlamydospores were stained best in dilute hematoxylin for about 24 hours followed by relatively long differentiation in 4% ferric

alum. Other staining technics tried were the same as those described for animal tissues.

Microchemical tests as described by Rawlins (1933) were made on both culture and tissue material for cellulose, chitin, callose, glycogen, starch, and fat.

MORPHOLOGICAL OBSERVATIONS

Gross Morphology

Hansen and Smith (1932) and Hansen (1938) have shown that variation occurs in pure cultures of certain imperfect fungi. They have established that pure cultures of these fungi are mixtures of two stable types and that these types can be segregated by making series of single spore cultures. Whether this phenomenon occurs in *C. immitis* is a subject for speculation.

A series of 25 single spore cultures of each of the fifteen cultures listed in Table I were made on synthetic agar. Some of the cultures exhibited slight differences. However, in subsequent single-spore cultures prepared from representative single-cell cultures of these strains, these differences were not constant. In one case, a third set of single-cell cultures gave the same results as did the second. To obviate the possibility that repeated culturing had eliminated variants, a series of 50 single spore cultures was made directly from the pus of a coccidioidal granuloma patient. All of the cultures appeared to be identical.

The gross morphological differences among the various strains on all three media were very striking. Photographs showing the strain differences on the three media incubated in the light are shown in Plate I, figs. 1 and 2; Plate II, fig. 1. The differences were most striking on potato dextrose and Sabouraud's glucose agar. For example, on Sabouraud's glucose agar the colony surfaces ranged from an almost flat, smooth colony with a tough tenaceous surface to a convex cottony colony, the aerial growth of which fragmented very readily. There were all gradations between these two types. Strain number 27 tended to form finger-like processes extending from a central knob which superficially resembled coremia. Similar structures were also observed in strain number 40, but instead of arising from a central prominence they were scattered over the surface of the flat central portion of the colony, assuming a counter-clockwise spiral arrangement.

In some strains (numbers 4 and 10) variations which appeared to be sectoring, were observed. However, subcultures from these sectors developed normally. If the original sectored cultures were incubated for two or three months, the entire surface of these colonies became covered with the downy type of growth characteristic of the sectors.

It has been shown by Coons and Levin (1926), Harter (1939), and Snyder and Hansen (1941) that light favored sporulation and darkness, mycelial development in the Fusaria and certain other fungi. On the

TABLE 1—HISTORY OF CULTURES

Culture No.	Date of Isolation	Isolated by	Geographical Location	Clinical History	Previous Investigations	Remarks
4	1938	Dr. C. E. Smith, Stanford Univ. School of Medicine, San Francisco, California	Kern Lake, Calif.	Coccidioidal granuloma, culture from abscess on arm	Baker and Mrak (1941)	Fatal
7	1938	Dr. C. E. Smith, Stanford	Yolo Co., Calif.	Primary coccidioidomycosis with erythema nodosum, culture from sputum		Recovered
8	1938	Dr. C. E. Smith, Stanford	Bakersfield, Calif.	Primary coccidioidomycosis with erythema nodosum, culture from sputum	Baker and Mrak (1941)	Recovered
10	1938	Kern County Health Dept.	Arvin, Calif.	Coccidioidal granuloma without cutaneous lesions, culture from pleural fluid		
11	1938	Kern County Health Dept.	Oildale, Calif.	Primary coccidioidomycosis without erythema nodosum, culture from sputum		Recovered
15	1938	Dr. C. E. Smith, Stanford	Tulare, Calif.	Primary coccidioidomycosis with erythema multiforme, culture from sputum		Illness originally diagnosed as small-pox. Recovered
17	1932(?)	Dr. C. F. Lehman, San Antonio, Texas	Texas	Coccidioidal granuloma, culture from lesion on left foot	Ota and Kawatsure (1933) Kawatsure (1934), Ciferri and Redaelli (1936)	Culture from Dr. F. D. Weidman
23	1924(?)	Dr. D. J. Davis, University of Chicago, Chicago, Ill.	?	Coccidioidal granuloma	Ota and Kawatsure (1933)	Culture from Dr. F. D. Weidman
27	?	Dr. A. Castellani, London School of Tropical Med. London, England	?	Coccidioidal granuloma (?)	Castellani and Jacono (1933) Ciferri and Redaelli (1936)	Culture from Dr. P. Redaelli
28	?	Dr. A. Castellani, London	The Balkans	Coccidioidal granuloma	Castellani and Jacono (1933) Ciferri and Redaelli (1936)	Culture from Dr. P. Redaelli
29	?	Dr. A. Castellani, London	Naples, Italy	Coccidioidal granuloma	Castellani and Jacono (1933) Ciferri and Redaelli (1936)	Culture from Dr. P. Redaelli
40	1939	Dr. C. E. Smith, Stanford	Bakersfield, Calif.	Primary coccidioidomycosis with erythema nodosum, culture from sputum		Recovered
41	1939	E. E. Baker, Stanford Univ. School of Medicine San Francisco, California	Stockton, Calif.	Bovine coccidioidal granuloma culture mediastinal lymph node	Baker and Mrak (1941)	
46	1933	Dr. du Bray, St Lukes Hospital, San Francisco, California	Probably San Joaquin Valley, Calif.	Coccidioidal granuloma	Lack (1938) Lack and Cronkite (1940)	Fatal
63	1939	Dr. C. E. Smith, Stanford	Tulare County, Calif.	Coccidioidal granuloma		Recovered

other hand, Yarwood (1937) showed that sporulation of certain of the downy mildews was more abundant in the dark, and that there was a diurnal effect. Most investigators who have studied *C. immitis,* grew the fungus in the dark of an incubator. Sets of cultures of *C. immitis* were maintained in both light and darkness but no significant differences were noted. Some of the cultures showed somewhat more abundant development in the light while others developed slightly better in the dark. There was no difference in the microscopic morphology.

The strains appeared to be quite stable. There was no correlation between gross morphology and clinical history, geographic source of isolation, or length of time in culture. Although the gross morphological differences observed in the fifteen strains were marked, they were not sharply defined but seemed to form a continuous series ranging from smooth surfaced to cottony and even mealy surfaced types. The differences were observed in "mass transfer" cultures as well as in the single-spore cultures. The taxonomic significance of the gross morphological differences will be discussed later.

Microscopic Morphology

Discussion of the microscopic morphology is divided into that of the organism as a parasite in animals (termed "parasitic phase"), and in culture (termed "culture phase"). These terms are used solely for convenience. Most strains showed a remarkable uniformity in microscopic morphology, the differences being quantitative rather than qualitative. Some strains produced a greater amount of surface mycelium and consequently relatively greater numbers of chlamydospores. Chlamydospores were of two types, cylindrical and spherical, and were either terminal or intercalary, frequently catenulate. Some strains produced more of the spherical type than others, but this character was not constant. The following description is based almost entirely upon the morphology of strains number 4 and 46. These two strains represented the extremes in morphologic variation, as will be pointed out later. Most strains, however, were not distinguishable microscopically from number 46. The uniformity in the morphology of the parasitic phase was even greater than of the cultural phase.

Parasitic Phase: Either in the tissues of man, naturally infected with *C. immitis,* or in the tissues of experimentally infected animals, the mature fungus is a spherical structure, usually termed a spherule, containing numerous endospores (Plate II, figs. 2, 6, 7, 9, 10; Plate III, fig. 1). The nature of the spherule will be discussed later. It is surrounded by a refractile double wall which may be 2 μ thick. The thin inner wall is composed of chitin and the thick outer wall of a substance which does not react with any stains used and is not chitin, cellulose, or callose as determined by the procedures described by Rawlins (1933). It is suggested that this outer wall is composed of some polysaccharide although

attempts to adapt Molisch's test for carbohydrates to microscopic use failed. Usually the spherule wall is smooth but sometimes may be covered with numerous excrescences. These structures may be fine (Plate III, fig. 9) or club-like (Plate III, fig. 2). The fine excrescences have been observed by many investigators and have been termed "prickles" by Dickson (1937b). The club-like excrescences formed around the spherules of *C. immitis* have been reported by Almeida (1934b) and Henrici (1940). These structures, termed "actinomycetoid forms" by Henrici, are not peculiar to any type of fungus. They have been observed by Almeida surrounding *Paracoccidioides braziliensis*, *Aspergillus fumigatus* and *Trichosporium pedrosoi* in human and experimental infections with these fungi. Henrici (1940) stated that they are also found in sporotrichosis and have been obtained experimentally with certain acid-fast bacteria and actinomycetes. He considered them to be the result of an allergic state developed following infection.

The spherules are quite variable in size, ranging from about 15 to 80 μ in diameter. Schenken and Palik (1942) report a very large spherule measuring 262 μ in diameter with a capsule 21 μ thick. Mature spherules are usually found in giant cells or histiocytes of the host (Plate II, figs. 2 and 3). The endospores contained within the spherule may be spherical or sub-spherical (Plate II, fig. 2; Plate III, fig. 1) or irregular in shape (Plate II, figs. 6, 7, 9, and 10). The endospores may be as small as 2 μ or as large as 5–10 μ in diameter. Occasionally a spherule is seen containing only a few large endospores. Plate III, fig. 5 shows such a spherule containing three endospores each about 40 μ in diameter. The exact significance of such a structure is not known but it is supposed that in this case cleavage ceased after the formation of the second cleavage plane. The small irregular endospores have a thin wall and probably represent immature spores. The larger endospores usually have a thick wall resembling that of spherules (Plate III, fig. 7).

The endospores are released by rupture of the wall of the spherules. In view of the variation in size and shape of the endospores, it is reasonable to assume that when the spores are first formed they are irregular and then tend to attain a more nearly spherical shape. Presumably the spores enlarge and finally rupture the spherule wall because of increased pressure on the wall. The released spores develop into immature spherules, and sporulation again occurs by the formation of successive cleavage planes. There appears to be no relationship between size of the immature spherules and the initiation of spore formation. Plate II, fig. 5 shows a small spherule about 15 μ in diameter in which the first cleavage plane has formed, and Plate II, fig. 8 shows a very large spherule about 80 μ in diameter in which cleavage planes have not as yet appeared. In Plate II, figs. 6 and 7 are shown spherules in which only a few cleavage planes have been formed. In these spherules the spore initials are still quite irregular. The protoplasm in immature spherules may fill the

entire structure (Plate II, fig. 8) or be distributed around the periphery (Plate II, figs. 4 and 11). Cleavage planes may divide the protoplast first into two, then four, etc., irregular segments (Plate II, fig. 9). These spore initials may then enlarge to form a few large endospores (Plate III, figs. 1 and 5) or additional cleavage planes may divide them into many small spores (Plate II, fig. 10). In the tissues of guinea pigs the spherules are usually non-vacuolated and the cleavage planes may divide them into many small spores. In contrast, in mice the spherules are usually vacuolated and the radial cleavage planes cut the peripheral protoplasm into segments as shown in Plate II, fig. 9 (although this photograph was taken of material from a guinea pig, it is more characteristic of that from infected mice).

Ciferri and Redaelli (1934a,b, 1936) reported that one strain of the fungus studied by them underwent conjugation, either isogamous or heterogamous, prior to sporulation. This phenomenon was observed in semianaerobic cultures prepared from pus of an experimentally infected guinea pig according to the technic of MacNeal and Taylor (1914). They stated that the protoplast of one cell passed through a conjugation bridge and fused with the protoplast of the other gamete. However, they were unable to secure sufficient material for cytological study. In pus from a guinea pig infected with strain number 40, structures resembling the figures of Ciferri and Redaelli were seen (Plate III, figs. 3, 4, 6, 7, and 8). In all of the structures, both halves contain protoplasm. Plasmogamy does not appear to have taken place either in the structures in which spores have not yet formed (Plate III, figs. 3 and 4) or in those in which spores have formed (Plate III, figs. 6, 7, 8). In fact, in Plate III, figs. 6 and 7, spores are present in one cell and the accompanying cell still contains protoplasm indicating definitely that plasmogamy has not occurred. Unfortunately the occurrence of these structures in tissue is so infrequent that staining procedures to determine the possible occurrence of karyogamy could not be carried out. However, in view of the absence of proof of karyogamy it is not wise at present to consider these structures as sexual. "Dumb-bell" shaped structures and swollen cells joined by a tube are seen in old cultures of all strains (Plate III, fig. 10). It seems likely that the structures seen in guinea pig pus may have originated directly from injected culture material and not by fusion of spherules. It is not possible to state whether the structures observed by Ciferri and Redaelli originated in this manner or whether they were actually the result of a sexual process.

The morphological changes accompanying the transformation of culture material (chlamydospores, oidia, and hyphal fragments) have not been investigated. There is some evidence that when culture material is injected into an experimental animal, the chlamydospores merely "round up" and enlarge into spherules. Ophüls (1905) stated that unless chlamydospores are present, culture material is not capable of producing

spherules when injected into experimental animals. However, Chope (unpublished data quoted by Dickson, 1937b) showed that very young cultures containing no chlamydospores could also produce spherules. The observations of Chope are as follows:

> ". . . after the injection of the suspension of chlamydospores the outline of the hyphae may be intact on the third day but . . . the chlamydospores are somewhat rounded and their outer capsule is well defined. At forty-eight hours some of these chlamydospores are well rounded out although still connected together as in the hyphae. At sixty hours the spherules are well developed and are as large (about 30 μ) as the immature spherules are likely to be when observed in pus from a patient. By seventy-two hours some of the spherules are filled with endospores, and in ninety-six hours some of them have burst, showing the manner in which the endospores are liberated and how the 'envelope' is formed."

Considerable time has been devoted to a study of the nuclear changes accompanying the development of spherules, but they have not been studied to the extent desired because of the small size of the nuclei and the difficulty in obtaining satisfactory stained preparations. In most of the preparations, the cytoplasm retained the nuclear stains as tenaciously as the nuclei. However, sections of mouse lung fixed in Flemming's strong solution diluted 1 : 2 and stained with Flemming's triple stain permitted some observations. The nucleus is characteristically spherical and about 1.5 μ in diameter. It has a rather delicate membrane which stains with gentian violet and a very small eccentrically placed nucleolus about 0.2 μ in diameter which stains with safranin (Plate V, figs. 2 and 3). It was not possible to make chromosome counts or to study the details of nuclear division because of the small size and because only very few dividing nuclei were seen in the material examined. It is assumed that the nuclei divide by the usual mitosis but the division figures were too small and indistinct for accurate interpretation. The smallest spores (or immature spherules, about 7 μ in diameter), seen free in the tissues contain two nuclei (Plate VI, fig. 1), which divide (Plate VI, fig. 2) simultaneously. This process is repeated, giving successively four, eight, etc., nuclei (Plate VI, figs. 3, 4, 5, and 6). The number of nuclei formed in this structure could not be determined beyond about eight nuclei. In a large spherule about 50 μ in diameter (Plate VI, fig. 6) numerous nuclei are seen scattered throughout the peripheral protoplasm. It was not possible to follow the nuclear changes during the formation of cleavage planes. In Plate VI, fig. 7 is shown a large spherule divided into numerous irregular segments containing a variable number of nuclei. These segments appear similar to the protospores of some of the Mucorales. Probably some of these segments normally would be subdivided further before formation of mature endospores. Plate VI, fig. 8 shows a mature spherule containing mature endospores with thick walls. These endospores contain from one to four nuclei. In one spore a dividing nucleus can be seen. It seems probable that all of the nuclei in a developing spherule normally divide simultaneously, for if they divide independently it is likely that more dividing nuclei would have been observed.

Although Moore (1932), Dodge (1935), and Stewart and Kimura (1940) stated that the spherules are asci, no evidence of "free cell" formation was observed. The cytological observations are essentially in agreement with the observations of Ciferri and Redaelli (1936). They stated, however, that the endospores are uninucleate, while according to the present observations they may be uninucleate, or irregularly multinucleate.

Satisfactory preparations showing nuclear changes during germination of endospores were not obtained. However, it seems possible that these changes are the same as in germinating chlamydospores (Plate IV, figs. 13 and 14; Plate V, fig. 1; Plate VII, fig. 1) which will be described later.

Cultural Phase: When pus is planted on artificial culture media, the immature spherules and the endospores, either free or contained within a spherule, germinate by the formation of one or more germ tubes (Plate III, figs. 11, 12, 13, 14). Very soon after the formation of a germ tube, which occurs as early as four hours after inoculation, branches may form (Plate III, figs. 11 and 12). Septation may occur either before (Plate III, fig. 12) or after branching (Plate III, fig. 13). After twenty-four to forty-eight hours a complex network of hyphae is formed. In young cultures (four to seven days) the hyphae are 2–4 μ in diameter and irregularly septate (Plate III, figs. 15 and 16). After about seven to ten days, many of the cells of the aerial hyphae develop into oidia and chlamydospores (Plate III, figs. 18 and 19; Plate IV, figs. 1, 2, 3, and 4). Oidia probably represent stages in the formation of chlamydospores since they are similar in structure to chlamydospores, differing only in having slightly greater size and lacking a thick wall. These oidia are not strictly comparable to the conidia of the genera *Oidium* and *Oospora*, in that they may be either terminal or intercalary. There may be several oidia together in a chain or there may be short chains separated by ordinary hyphal cells. The oidia mentioned by Ophüls (1905), MacNeal and Taylor (1914), Wolbach (1904) and others are in reality not oidia but chlamydospores. The oidia and chlamydospores usually disarticulate readily. At about the same time that the oidia and chlamydospores are formed some of the hyphal cells become swollen at one end resembling the clavate cells of the "racquet" mycelium of the dermatophytes (Plate III, fig. 17). These cells are thin-walled and quite variable in size. The oidia are about 2–4 μ in diameter and may attain a length of 6–8 μ. The chlamydospores are generally cylindrical or with sides slightly convex and measure 2–4 x 2–4 μ or 2–4 x 3–6 μ (Plate III, figs. 18 and 19). However, they are at times ellipsoidal to nearly spherical. Strain number 4, in particular, produces this type of chlamydospore commonly measuring up to 10 μ and occasionally 20 μ in diameter (Plate IV, figs. 2 and 3). Sometimes chlamydospores are seen which appear to have been formed by septation of spindle-shaped cells into two, three, and even four cells (Plate III, fig. 19; Plate VII, fig. 5). The composition of the medium has no effect upon the characteristics of the chlamydospores.

When chlamydospores are placed on fresh media they germinate by the formation of germ tubes in much the same manner as do endospores (Plate IV, figs. 5 and 6). Subsequent development is identical with that of endospores.

The cells of the hyphae usually contain one or two nuclei (Plate VII, figs. 2 and 3). The chlamydospores are usually either uni- or binucleate (Plate VII, figs. 4 and 5) but some of the larger chlamydospores may contain four nuclei (Plate VII, fig. 4). When the chlamydospores germinate, germ tubes usually form before the first nuclear division (Plate VII, fig. 1). The nucleolus in the nuclei of germinating chlamydospores is considerably larger than that in the nuclei of spherules, endospores, mature hyphal cells, or chlamydospores, and ranges from about 0.75 to 1.0 μ in diameter (Plate IV, figs. 13 and 14; Plate V, fig. 1). There are either one or two nuclei in the cells formed by septation of the young hyphae.

It is generally considered that the only vegetative reproductive structures produced by *C. immitis* growing in culture are oidia and chlamydospores. MacNeal and Taylor (1914), and Ciferri and Redaelli (1936) observed continued multiplication of spherules when pus from infected animals was inoculated into a medium composed of Tyrode's solution to which was added slices of sterile tissues. Lack (1938) showed that under conditions of semianaerobiosis chlamydospores developed into spherules when inoculated into beef infusion broth containing partially coagulated egg albumin. These two technics attempted to simulate conditions in the animal body.

However, Baker and Mrak (1941) have shown that certain strains of the fungus produce structures in culture closely resembling the spherules found in animal tissues. These are not carried over from animal tissues because strain number 4 has been maintained in culture since 1937. These culture spherules range in size from about 10 to 20 μ in diameter, and are characteristically spherical but sometimes oval. They are terminal or intercalary. Endospores develop by the formation of successive cleavage planes in the culture spherule. Mature spores are usually irregular in shape but occasionally may be spherical. When the spherules are placed in liquid media or on agar, they germinate by the formation of germ tubes.

Subsequent to the above investigation, one immature culture spherule in which the first cleavage plane had formed was observed during examination of a four-month-old culture of strain number 46 (Plate IV, fig. 7).

Most of the stained preparations of culture spherules proved inadequate for cytological study. In a slide culture fixed in formalin-acetic acid-alcohol solution and stained with iron hematoxylin, a few spherical chlamydospores without cleavage planes were seen (Plate VII, figs. 6, 7, and 8). Structures with two, four, and eight nuclei were observed. Unfortunately, the entire development could not be studied.

In one-month-old slide cultures of strain number 4, fixed in formalin-acetic acid-alcohol solution and stained with 1% aqueous cotton blue solution and mounted in balsam, structures resembling zygospores were observed (Plate IV, figs. 8, 9, 10, 11, and 12). The earliest stage resembled nothing more than hyphal fusion (Plate IV, fig. 8). Later the bridge joining the two hyphae became broader and, finally, the structure became spherical and assumed a thick wall (Plate IV, fig. 12). The supporting hyphae were then empty. Sometimes the smooth wall, resembling the wall of the spherules (tissue and culture), was quite thick. The explanation of these structures is somewhat difficult but it is possible that they represent primitive zygospores lacking the usual suspensors; on the other hand, they may be only an unusual form of hyphal fusion that has formed chlamydospores.

Thus far, attempts to reproduce these structures have been unsuccessful and consequently cytological studies have not been made. Since these structures have been observed only in a few fixed and stained slide cultures, germination experiments have not been possible.

LIFE CYCLE

The life cycle of *C. immitis* has always been a problem because of the great difference between the parasitic and the cultural cycles. The tendency has been to consider that this fungus possesses two distinct life cycles depending upon the environment (Moore, 1932; Ciferri, 1932; Dodge, 1935; Ciferri and Redaelli, 1936; Stewart, 1942). According to this concept, the fungus reproduces in the parasitic state by means of endogenous spore formation within the spherules and in the saprophytic state by formation of oidia and chlamydospores.

At the present time culture spherules have been observed on only four strains, numbers 4, 8, 41, and 46, and constantly on only one strain, number 4. The factors affecting the production of culture spherules are not known. According to Baker and Mrak (1941), the culture spherules did not appear until after active growth of the fungus had ceased because of drying, "staling products" in the medium or both. In a semi-solid medium containing copper sulfate, the culture spherules were formed before drying alone could have become an important factor. However, it may be that drying increased the concentration of copper to a toxic level, thereby restricting hyphal development. No definite explanation was given for the failure of other strains to produce culture spherules under the conditions described. All strains were pathogenic and morphologically similar. The suggestion was offered that strains not producing culture spherules had lost this ability or that they were less susceptible to conditions inducing spherule formation. The behavior of strain number 41 suggested that the explanation lies in a loss of ability to produce spherules in culture.

The finding of spherules produced in culture eliminates the need for

postulating two distinct life cycles. It is hoped that in the future the conditions necessary for the production of culture spherules by all strains will be found. A diagrammatic representation of the life cycle of *C. immitis* is given in Plate VIII. When an endospore is placed on artificial media, it germinates, forming a mycelium composed of septate hyphae. Later some of the cells of the hyphae are differentiated into oidia and chlamydospores which are capable of germination on fresh media to repeat the cycle. In some strains (number 4 in particular) certain of the hyphal cells enlarge, develop a thick wall and produce endospores by cleavage. These endospores are also capable of germinating to repeat the cycle. If the chlamydospores and oidia (and probably culture spherules and endospores) gain access to animal tissues, either by injection or through the respiratory tract, they undergo a series of imperfectly known changes to form mature spherules containing endospores. According to Chope (see Dickson, 1937b) this process consists of enlargement of the chlamydospores with the formation of endospores. This sequence of events is made more probable by the process of culture spherule formation which occurs in a similar manner. The endospores formed in mature spherules are capable of either repeating the cycle in tissues or beginning a new cycle in culture.

In this concept of the life cycle, there is still a remarkable difference between the cultural cycle and the parasitic cycle. However, certain analogies and assumptions will aid in making them less divergent. The essential difference between the complete cultural cycle (with culture spherule production) and the parasitic cycle is the complete absence of hyphal development in the latter. If the parasitic condition is considered as abnormal for the development of the fungus, possibly the development of the fungus has been reduced to a form which produces the greatest number of reproductive structures with the least synthesis of new protoplasm. In other words, the environmental conditions imposed by animal tissues completely restrict hyphal development, which is less profitable from a reproductive standpoint. This is not an uncommon phenomenon since it occurs in *Sporotrichum*, *Histoplasma*, *Blastomyces*, etc., in animal tissues and in certain cultural conditions. A similar process also occurs in *Empusa* in which the conidia germinate to form a second conidium when the first conidium is placed in unfavorable environmental conditions (see Fitzpatrick, 1930).

TAXONOMY

From a taxonomic standpoint, *C. immitis* presents a difficult problem. Posadas (1892) believed that he was studying a protozoan and discussed a possible relationship with the Gregarines of the *Psorospermia* (*Sporozoa*) but did not arrive at any definite conclusion and did not propose a name. Wernicke (1892) studied material from the same case but he

also did not propose a name.[3] No cultures were made by either Posadas or Wernicke.

In 1896, Rixford and Gilchrist published the results of a study of the first two North American cases of coccidioidal granuloma and for the first time gave a definite name to the organism. They also believed that they were dealing with a protozoan parasite and after consultation with the protozoologist, Stiles, described the genus *Coccidioides* and the two species, *C. immitis*[4] and *C. pyogenes*.

In 1898, at the First Latin-American Medical Congress, Cantón proposed the name *Posadasia sphæriformis*. This name is not valid because it is antedated by *C. immitis* and because the proceedings of this Congress were mimeographed but not formally published.

Ophüls (1905) showed that the two species of Rixford and Gilchrist were identical since the differences could be observed in experimental animals inoculated with a single strain of the fungus. He rejected the name *C. immitis* because Rixford and Gilchrist described a protozoan, tentatively proposing to name the fungus either *Oidium coccidioides* or *O. protozoides* in spite of the fact that he considered the structures found in animal tissues to be asci. It must be pointed out that Ophüls' usage of *Oidium* is not comparable to the original description of *Oidium*.

Verdun (1907) created the combination *Oidium immite*, for the first time using the name *immitis* in a mycologic sense. Brumpt (1910), in the first edition of his Précis de Parasitologie, used the name *C. immitis*. He placed the fungus in the Hyphomycetes and stated that it showed relationships with certain of the Ascomycetes (*Endomyces* and *Saccharomyces*).

Hartmann and Schoo (1912), working in Holland, studied an autopsy specimen from a patient with a disease diagnosed as cancer. Later, Hartmann (1912) briefly described *Blastosporidium Schooii* as the cause of the disease and placed it in the *Haplosporidia*. He commented upon the possibility of its identity with *C. immitis*. Brumpt (1927 and later editions) considered *Blastosporidium Schooii* to be identical with *C. immitis*. Unfortunately, however, Hartmann and Schoo failed to obtain cultures. Hartmann's figures and description are not entirely typical of *C. immitis*. It is possible that the two organisms are not identical, a view already pointed out by Ciferri and Redaelli (1936). In addition to suggesting

[3] It is frequently stated (Almeida, 1933; Dodge, 1935; Ciferri and Redaelli, 1936; and others) that Posadas and Wernicke used the generic terms *Megalosporidium* and *Megalocytosporidium* for *Coccidioides*. However, upon examination of their papers (Posadas, 1892, 1900; Wernicke, 1892) we were unable to find these names. At the present time the exact origin of these names has not been determined.

[4] The description of *C. immitis* is usually credited to Stiles. However, Rixford and Gilchrist (1896) published Stiles' letter containing suggestions regarding the nomenclature and systematic relationships of this organism. This letter contained no description of the organism. Rixford and Gilchrist did give a description and assumed full responsibility for it. Thus the correct nomenclature should be *Coccidioides immitis* Rixford and Gilchrist 1896 and not *C. immitis* Stiles as is frequently given.

a relationship between the two organisms, Hartmann, for the first time, suggested that *C. immitis* is a Phycomycete.

In the second edition of his Précis de Parasitologie, Brumpt (1913) introduced a new name in the literature, namely: *Mycoderma immite.* He made this change in spite of the fact that *C. immitis* never forms a yeast-like pellicle, which is the most important characteristic of the "medical" genus *Mycoderma* as defined by Vuillemin (1931). He also retained this name in the 1927 edition although he returned to the name *C. immitis* in subsequent editions.

Although, as stated above, Hartmann first suggested the relationship of *C. immitis* with the Phycomycetes, Langeron (1922) is usually credited with this suggestion since he noted in animal tissues the formation of endospores by the process of cleavage, and suggested placing this organism in the Oomycetes near the Chytridiales.

In 1927 Castellani created a new genus *Blastomycoides* to include *Blastomyces* Gilchrist and Stokes, *Coccidioides* Rixford and Gilchrist, *Oidium* Link (in part), *Cryptococcus* Kützing (in part), and *Zymonema* Beurmann and Gougerot (in part). In this genus he included three species: *B. immitis, B. dermatitidis,* and *B. Tulanensis.* The first two species are probably identical. *B. Tulanensis* has been shown to be identical with *Blastomyces dermatitidis* (Martin, 1939) and is entirely unrelated to *C. immitis.* Castellani grouped *C. immitis* with these other organisms because he considered the endospores to be granules or fat droplets rather than spores. Castellani and Jacono (1933) discontinued the use of the name *Blastomycoides* and placed *C. immitis* in the genus *Geotrichum,* following Agostini (1932).

Mazza and Parodi (1927) published a report of a case of coccidioidal granuloma of the larynx. They considered the organism to be identical with that of Posadás and Wernicke but did not make cultures. In the following year Fonseca (1928), after studying the sections from the case of Mazza and Parodi, established a new genus and species *Pseudococcidioides Mazzai* for the parasite. He suggested that both *Pseudococcidioides* and *Coccidioides* are related to the genus *Protomyces.* In a previous paper (Fonseca and Leão, 1927) a relationship between *Coccidioides* and *Protomyces* is mentioned, with the suggestion that a search be made for *C. immitis* in this group of plant parasites.

Almeida (1932b,c, 1934a) after comparing material from the case of Mazza and Parodi with material from cases of coccidioidal granuloma (human and experimental) concluded that the genus *Pseudococcidioides* should be reduced to synonomy with *Coccidioides.* He pointed out that Posadas (1892) and Rixford and Gilchrist (1896) had figured forms of *C. immitis* identical with *Pseudococcidioides Mazzai.* In fact, Rixford and Gilchrist's description of *C. pyogenes* bears a great resemblance to Fonseca's description of *Pseudococcidioides Mazzai.*

Until 1929 it was generally considered that *C. immitis* occurred in

Brazil. Almeida (1929, 1930a,b) made a comparative study of *C. immitis* from the United States and of the supposed *C. immitis* from Brazil and showed that they are not identical. He established the genus *Paracoccidioides* for the Brazilian fungus with the species, *braziliensis*. For a complete discussion of this fungus see Almeida (1933), Redaelli and Ciferri (1937), and Moore (1938).

Moore (1932) concluded that the spherules found in tissue are asci and created the family Coccidioideaceae in the Endomycetales. He recognized the species *C. immitis* for the North American fungus and returned the Brazilian fungus to this genus with the species name *esferiformis* originally proposed by Cantón (1898) for *C. immitis* (see Ciferri and Redaelli, 1936). Later Moore (1935) included in this family *Posadasia* (Cantón) Moore (an invalid name for *Histoplasma* Darling (see Ciferri and Redaelli, 1936), *Paracoccidioides* Almeida, and *Rhinosporidium* Minchin and Fantham. Ciferri (1932) independently of Moore, established the family Coccidioideaceae, placing it in the Chytridiales and including in it *Coccidioides* Rixford and Gilchrist and *Paracoccidioides* Almeida.

Ota and Kawatsure (1933) published a study of fungi causing blastomycosis. Included in this group of fungi were *C. immitis* and an organism previously described by Ota (1926; in Japanese) as *Scopulariopsis americana* Ota. Ciferri and Redaelli (1936) studied one of the four cultures of this fungus (stated by Ota and Kawatsure to be identical) and found it to be a slightly atypical culture of *C. immitis*.

Dodge (1935) followed Moore in placing *Coccidioides* in the family Coccidioideaceae Moore, but reduced *Coccidioides esferiformis* to synonomy with *C. immitis*.

In 1936 Ciferri and Redaelli published an extensive study of fifteen strains of *C. immitis*. They reaffirmed Ciferri's (1932) belief of a relationship with the Chytridiales. They removed *Paracoccidioides* from the family Coccidioideaceae and added *Rhinosporidium*, at the same time discussing the relationships between *Coccidioides* and various Chytridiales (many of which Fitzpatrick, 1930, considered as doubtful chytrids) and proposing a possible phylogenetic scheme. They recognized the single species *C. immitis* with the three varieties: *typicus*, *metaeuropeus* and *Pipkini*.

It is apparent that there has been considerable controversy regarding the nature of the spherule. Most investigators have described and figured spore formation by the process of cleavage. The present study indicates that the spores both of tissue and culture spherules are formed by cleavage and not by "free cell" formation. In the opinion of the authors, there is little doubt but that the spherules are sporangia and not asci.

In view of this formation of endospores by cleavage, *C. immitis* cannot be placed in the Ascomycetes despite its septate mycelium. Neither basidiospores nor clamp-connections have been observed by previous in-

vestigators or by the authors. Since these structures are the chief basis for the differentiation of the Basidiomycetes, it appears impossible to include *C. immitis* in this group of fungi. Inclusion of this fungus in the Fungi imperfecti has been the proposal of various investigators, notably: Castellani (1927), Agostini (1932), Castellani and Jacono (1933), and Ota and Kawatsure (1933). An attempt was made to classify *C. immitis* in this group using the keys of Clements and Shear (1931). Since no conidia (except oidia-like structures which probably represent a stage in the formation of chlamydospores) are formed, the only possible relationship would be with the *Mycelia sterilia*. However, fungi in this group possess no reproductive structures of any kind, whereas *C. immitis* forms chlamydospores. Also, the production of sporangia in the host tissues and occasionally in culture would eliminate any relationship with this group, the members of which are generally considered to be imperfect representatives of the Ascomycetes. Thus, it is impossible to classify *C. immitis* in the Fungi imperfecti.

The most probable relationship is with the Phycomycetes because of the formation of the sporangium. However, *C. immitis* presents certain characteristics inconsistent with such a relationship. For example, the mycelium is septate from the initiation of hyphal development, a characteristic of the Ascomycetes and Basidiomycetes. Sporangia are rare in culture and are not borne on erect sporangiophores as is characteristic of the terrestrial Phycomycetes.

The exact systematic position of *C. immitis* among the Phycomycetes presents further difficulties. Since *C. immitis* has a well developed mycelium and grows readily on very simple media, relationship with the higher Oomycetes or Zygomycetes might be expected. However, the sporangium is not typical of the Oomycetes or Zygomycetes. There are no definite sporangiophores, a condition not found above the level of the Pythiaceae of the Peronosporales. In culture, the sporangia are terminal or intercalary, solitary, or in chains. Again this condition is not found above the level of the Pythiaceae and not at all in the Zygomycetes. The sporangium is thick-walled, a condition not found in either the Oomycetes or Zygomycetes, although the upper half of the sporangium in both *Pilobolus* and *Pilaira* is thickened (Fitzpatrick, 1930).

If only the parasitic cycle of *C. immitis* is considered, this fungus is reminiscent of the Chytridiales in that the entire thallus is transformed into a single reproductive structure. Ciferri and Redaelli (1936) have attempted to trace a relationship with this group. However, there are certain objections to this view. *C. immitis* has a highly developed, septate mycelium and grows well on very simple media. In contrast, the Chytridiales produce motile zoospores and are, for the most part, obligate parasites, with the mycelium, when present, evanescent. Ciferri and Redaelli point out that certain members of the Chytridiales (*Catenaria*, *Hypochytrium*) have septate mycelia. While *Catenaria* does have a

primitive mycelium, it is by no means comparable to that of *C. immitis*. *Hypochytrium* has a well developed mycelium, but Fitzpatrick (1930) expresses some doubt as to its relationship with the Chytridiales. Ciferri and Redaelli did not observe motile spores and are of the opinion that because of the environment (animal tissues) *C. immitis* has lost the ability to produce motile zoospores. However, the endospores produced by *C. immitis* in culture are also aplanetic. They state that *Hypochytrium infestans* produces zoospores, some of which lose their flagella before emergence. However, none of the Chytridiales form only aplanetic zoospores. Most of them are obligate parasites or at least have not been cultured. Recently Karling (1934) has cultured *Catenaria Anguillulae* on boiled fluke eggs and vegetables. *Macrochytrium botrydioides* is saphrophytic on rotten fruit in water according to Minden's (1902) description. According to Fitzpatrick (1930) the latter fungus is a doubtful member of the Chytridiales. In contrast to the predominately obligate parasitism and simple structure of the great majority of the Chytridiales, *C. immitis* is not an obligate parasite and produces a complex thallus on very simple media. Thus, it is difficult to accept a relationship with the Chytridiales.

Fonseca (1928) described *Pseudococcidoides Mazzai*, now known to be identical with *C. immitis*, and made the following statement (translated) concerning its systematic position:

> "*Pseudococcidioides mazzai* is probably best placed in the family *Protomycetaceae* in the *Hemiascomycetes* which are transitional between the *Phycomycetes* and the *Ascomycetes*. It is near *Coccidioides* from which it is distinguished primarily by the mode of formation of spores which separate in groups within the membrane of the mother cell."

Fonseca based the separation of *Pseudococcidioides* from *Coccidioides* on the formation of endospores in the former by cleavage of the cytoplasm arranged around the periphery of the spherule. He did not study cultures of this organism because none were obtained. Almeida (1932 b,c, 1934a) pointed out that this type of sporulation also occurs in *C. immitis*. Rixford and Gilchrist (1896), Ophüls (1905), and others as well as the authors, have also observed this type of sporulation in *C. immitis*. It was this cleavage of peripherally arranged cytoplasm that led Fonseca to suggest a relationship with *Protomyces*.

Büren (1915) has shown that in *Protomyces* the delicate intercellular, septate mycelium bears large, globose to ellipsoidal, thick-walled, unicellular chlamydospores which may be either terminal or intercalary. After a period of rest, chlamydospores germinate by rupture of the thick exospore and the extrusion of the thin endospore as a globose or cylindrical sack. When the sack is fully formed, it contains a peripheral multinucleate layer of protoplasm which is soon divided by cleavage planes into many small uninucleate segments. The nuclei in these segments divide twice, forming four nuclei, and eventually four uninucleate

spores. Finally these spore tetrads break up and the spores aggregate in a clump near the tip of the extruded sack. After release, the spores copulate in pairs. The nuclei migrate into the copulation bridge but it is uncertain whether or not they fuse. When these spores reach the epidermis of the host, they put out germ tubes which penetrate between the epidermal cells, and repeat the cycle. The exact position of meiosis in the life cycle is not clear.

The question of a possible relationship between the genera *Protomyces* and *Coccidioides* appears to lie in the mode of formation of endospores and their subsequent development. In *Coccidioides* the spores are undoubtedly sporangiospores. At the present time the life cycle of *Protomyces* is not clear. Büren considers the cells cut out of the peripheral cytoplasm to be asci and the four spores formed in them to be ascospores. He terms the sack extruded from the chlamydospores a "synascus." He believes that meiosis probably occurs in the formation of the spore tetrads. Gaümann and Dodge (1928) offer another possible interpretation as follows:

> "If one wishes to avoid this explanation (meiosis during formation of spore tetrads), one must assume that the quartering of the spore mother cells does not have the significance of a meiosis and that the spore mother cells, like the protospores of the *Mucoraceae* and *Synchytriaceae*, represent only an intermediate stage not connected with a change of nuclear phase. Meiosis then, as in the *Dipodascaceae* and *Endomycetaceae*, would be sought in connection with the nuclear fusion in the beginning of nuclear divisions at the emergence of the endospore. Like the ascus of *Dipodascus*, the endospore would correspond to an ordinary ascus with still definite sporangial character, but encysted like the zeugites of many parasitic *Basidiomycetes*."

In both of these interpretations, the spores are assumed to be ascospores and therefore could not correspond to the endospores of *C. immitis*. On the other hand, Gwynne-Vaughn and Barnes (1937) interpret the chlamydospore of *Protomyces* as a resting sporangium and place this genus in the order Protomycetales near the Chytridiales and Ancylistales. Fitzpatrick (1930) summarizes the situation as follows:

> "The position of the family *Protomycetaceae* in the natural system is in doubt, any disposition of it being to an extent dependent upon the interpretation given to the structures and phenomena just described. Unless the extruded endospore be regarded as a many-spored ascus there would seem to be no reason for incorporating these forms in the *Ascomycetes*."

In addition to the genus *Protomyces*, the family Protomycetaceae contains two other genera: (see Gaümann and Dodge, 1928) *Protomycopsis* and *Taphridium*. In both *Protomyces* and *Protomycopsis* the spores are delimited in the extruded sack but the spores do not copulate in *Protomycopsis* as they do in *Protomyces*. In *Taphridium* the spores are delimited in the thick-walled chlamydospore before extrusion of the endospore. In at least one species the spores have been described as fusing in pairs after their escape.

If *C. immitis* is compared with these three genera, certain similarities as well as differences can be seen. In *Protomyces* and *Protomycopsis* the spores are delimited in the extruded sack while the spores in *C. immitis* and *Taphridium* are delimited within the original chlamydospore.[5] *Taphridium* differs from *C. immitis* in that the spores of *Taphridium* pass into an extruded sack before release while the spores of *C. immitis* are released directly by rupture of the sporangium. The released spores of *Protomyces* and some species of *Taphridium* copulate in pairs while those of *C. immitis* and *Protomycopsis* do not copulate (unless the observations of Ciferri and Redaelli (1936), of a fusion of cells before sporulation in a strain of *C. immitis*, is confirmed). *C. immitis* differs from the other genera in several important respects. *C. immitis* grows readily on simple media while the other genera are obligate parasites on higher plants or at least have not been cultured. *C. immitis* produces small cylindrical chlamydospores which are incapable of functioning as sporangia in culture but which are probably able to do so in animal tissues.

On the basis of present information, it appears possible to suggest a relationship with the three genera, *Protomyces*, *Protomycopsis*, and *Taphridium*, even though members of these genera have not yet been cultured. *C. immitis* may even be included in the family Protomycetaceae although this would be unwise without more information regarding the details of the life histories of these four genera. Moore (1932) established the family Coccidioidiaceae placing it in the Endomycetales. Ciferri and Redaelli (1936) amended the description of this family and placed it, as well as the family Protomycetaceae, in the Chytridiales. No attempt will be made at the present time to further amend the description of the family Coccidioidiaceae or to merge it with the Protomycetaceae although this latter change may be desirable in the light of future data. The following statement from Fitzpatrick (1930) probably best summarizes any attempt at an exact taxonomic treatment of either the family Protomycetaceae or *C. immitis:*

> "as treated here the *Protomycetaceae* are regarded as of unknown relationship. They may represent an isolated line of development with a phycomycetous ancestry, . . ."

Emmons and Ashburn (1942) have recently described a new species of fungus, *Haplosporangium parvum*, recovered from several genera of wild rodents in Arizona. *C. immitis* was also isolated from the same genera of rodents and in some cases both fungi were obtained from one animal. From their description no morphological similarities are apparent between *H. parvum* and *C. immitis*. An antigen prepared from *H. parvum* produced more positive skin reactions in individuals giving positive coccidioidin skin tests than in individuals giving negative coccidioidin

[5] The term chlamydospore has been used to designate the structure in which the spores of the various Protomycetaceae are formed. In the present discussion this term is also applied to the spherule of *C. immitis* for comparison.

tests. On the basis of this, speculation is made of a possible genetic relationship between *H. parvum* and *C. immitis*. While such a relationship may be possible, more evidence is needed, particularly in view of known cross-serological reactions between unrelated organisms.

On the basis of available information the genus *Coccidioides* may be defined as follows:

Genus *Coccidioides* Rixford and Gilchrist 1896; emend 1943.

Synonomy: *Posadasia* Canton 1898
Oidium of Ophüls, 1905, not Link.
Blastosporidium Hartmann 1912 (?)
Mycoderma (in part) of Brumpt, 1913, not Persoon
Blastomycoides Castellani, 1927 or 1926
Pseudococcidioides Fonseca, 1928
Geotrichum (in part) of Basgal, 1931, not Link
Scopulariopsis (in part) of Ota, 1928, not Bainier
Glenospora of Castellani and Jacono, 1933, not Berkeley and Curtis

Colonies on solid media circular, raised, or flat, with or without a prominent central boss; surface cottony, powdery, or smooth and membranous; color white becoming brown with age. Thallus in animal tissues reduced to a single cell; in culture branched and well developed; hyphae absent in animal tissues; in culture septate at all stages of development, 2–4 μ in diameter. Vegetative reproduction in animal tissues by formation of holocarpic thick-walled sporangia (termed spherules), up to 80 μ in diameter, number of sporangiospores variable, few to several hundred, thin or thick-walled, spherical to globose or irregular in shape, 2–3 x 2–3 μ, occasionally up to 5–10 x 5–10 μ, formed by successive cleavage planes; in culture sporangia rarely formed, when present terminal or intercalary, thick-walled, spherical to globose, ranging up to 20 μ in diameter, number of sporangiospores variable, fewer than in tissue sporangia, sporangiospores usually thin-walled, occasionally thick-walled, irregular, spherical or globose 2–3 x 2–3 μ; oidia globose, spherical or cylindrical 2–4 x 2–6 μ, occasionally up to 20 μ in diameter. Sexual reproduction not definitely established.

Type species: *C. immitis* Rixford and Gilchrist 1896.

Most investigators have made no attempt to differentiate species within the genus *Coccidioides*. However, Ciferri and Redaelli (1936) established three varieties: *C. immitis* var. *typicus; C. immitis* var. *Pipkini;* and *C. immitis* var. *meteuropeus*. The first variety represents the usual form of the fungus. The second variety is said to form (translated) " . . . a morphological complex with forms similar to those of *Scopulariopsis;* an atypical experimental histopathological picture in the guinea pig." An examination of a subculture (number 17) from this strain showed this culture to be similar to all of the other strains studied. The third variety was based upon the geographical location of its isolation, Naples, Italy.

The advisability of describing culture number 4 as a new species was

considered. However, in spite of the fact that it forms sporangia regularly in culture while the other strains form sporangia rarely or not at all, it seems inadvisable to describe an additional species. While the various strains show considerable and constant differences, there are no well differentiated colony types. Instead, the fifteen strains appear to form an integrated series, each strain differing a little from the other. Various physiological properties to be reported later were similar for all strains. The ability to utilize various carbon and nitrogen compounds is similar for all strains (Baker and Smith, 1942). The effect of pH on growth is also similar. Coccidioidin tests made by Smith and Baker (unpublished data) on two sensitive individuals using antigens prepared from all of the fifteen strains gave identical reactions to the various antigens. Thus, in the opinion of the authors, there is no justification for the description of additional species or varieties of *Coccidioides* on the basis of the present information, although it is possible that in the future they may be discovered.

On the basis of available information, the synonymy of *Coccidioides immitis* Rixford and Gilchrist 1896 follows:

Synonomy: *Coccidioides pyogenes* Rixford and Gilchrist 1896
Posadasia esferiformis Canton 1898
Oidium protozoides Ophüls 1905
Oidium coccidioides Ophüls 1905
Oidium pyogenes Verdun 1907
Oidium immite Verdun 1907
Blastosporidium Schooii Hartmann 1912 (?)
Zymonema immitis Mello and Fernandes 1918
Mycoderma immite Brumpt 1913 Second Edition
Blastomycoides immitis Castellani 1927 or 1926
Pseudococcidioides Mazzai Fonseca 1928
Scopulariopsis americana Ota 1926
Geotrichum dermatitidis Basgal 1931
Geotrichum immite Agostini 1932
Geotrichum louisianoideum Castellani, in Castellani and Jacono 1933
Glenospora metaeuropea Castellani, in Castellani and Jacono 1933
Coccidioides immitis var. *typicus* Ciferri and Redaelli 1936
Coccidioides immitis var. *Pipkini* Ciferri and Redaelli 1936
Coccidioides immitis var. *meteuropeus* Ciferri and Redaelli 1936

Characteristics are those of the genus.

DISTRIBUTION

Most investigators have assumed that *C. immitis* develops in soil and is distributed in dust. Up to the present time, the fungus has been isolated from soil in three different areas as will be mentioned below. However, the distribution of this fungus must be studied chiefly from the occurrence of reported cases of coccidioidomycosis and from the results of skin testing with coccidioidin testing (see Smith, 1940) for justification of this type of data.

Although the first case of coccidioidomycosis (coccidioidal granuloma) was reported by Posadas (1892, 1900) and Wernicke (1892) in Argentina, practically all of the subsequent cases have been recorded in the United States, particularly in the southern San Joaquin Valley region of California. Beck (1931) summarized the distribution of 286 cases of coccidioidal granuloma occurring prior to June 1, 1931.

California

The distribution of the fungus in California has now been fairly well established. Stewart and Meyer (1932) reported isolation of the fungus from soil collected near Delano in the San Joaquin Valley. Smith and Baker (1941) isolated *C. immitis* from two soil samples collected in San Benito County located in the eastern part of the coast range of mountains bordering the San Joaquin Valley. The lower San Joaquin Valley has long been considered an endemic area. Rixford's (1894) first case of coccidioidal granuloma originated in that area and subsequent investigations of Gifford (1936, 1942), Gifford, Buss and Douds (1937), Dickson (1937a,b, 1938a,b), Dickson and Gifford (1938) and Smith (1940) have provided confirmatory evidence. They studied the acute primary type of infection which has an incubation period of about 8–21 days. Consequently, the area in which the infections were acquired can be fixed with considerable certainty.

A rather large number of infections have been acquired south of the Tehachapi Mountains. Kessel (1941) stated that 31 of 100 patients having coccidioidal granuloma, seen at the Los Angeles County Hospital, acquired their infections in Southern California. Three infections are known to have occurred in San Diego County. Two infections definitely occurred in Riverside County (Thurber, 1929; Kessel, 1941).

In general, fewer cases are reported from the south coastal counties. Schwalenberg (1929) reported an infection acquired near Santa Barbara. Cases have also been recognized in Ventura County. Shelton (1942) reported several cases from Camp Roberts located in Monterey and San Luis Obispo Counties. In addition he performed coccidioidin tests on 888 newly arrived troops and retested the nonreactors three months later. During the three-month period, fourteen of this group had become infected as indicated by their having acquired sensitivity to coccidioidin. Davis, Smith and Smith (1942) reported an epidemic of acute primary coccidioidomycosis resulting from an exposure to dust in San Benito County.

There have occurred in Contra Costa and Yolo Counties a few isolated cases of primary coccidioidomycosis which apparently originated in these areas. However, *C. immitis* appears to be practically absent from the northern part of the San Joaquin Valley and the Sacramento Valley as well as the northern part of the state and the north coast range and the Sierra Nevada regions.

Arizona

Emmons (1942) isolated *C. immitis* from five of one hundred and fifty soil samples collected in the desert near the village of San Carlos. He was also able to isolate cultures of this fungus from rodents trapped in this same area. Phillips (1938), Woolley (1938), Brown (1939), Farness and Mills (1939), and Farness (1941) have reported cases of both primary coccidioidomycosis and coccidioidal granuloma originating near Tucson and Phoenix. Aronson, Saylor and Parr (1942) have shown a high incidence of positive reactions to coccidioidin among Indian school children on certain Indian Agencies near Phoenix and Globe.

Texas

Caldwell (1932, 1942), Smith and Waite (1934), Smith (1942), and Lehmann and Pipkin (1935) reported cases of coccidioidal granuloma from Texas in which the infections had been acquired in that state. Schulze (1942) has reported the presence of an endemic area in western Texas as indicated by the occurrence of cases of primary coccidioidomycosis.

United States other than California, Arizona, and Texas

Burkhead (1922), Van Cleve (1936), and Duckett and Fredeen (1936) reported cases of coccidioidal granuloma in Kansas; however, careful residence histories were not obtained. Duckett and Fredeen's patient, a boy of five, had lived in Texas and may well have acquired the infection there.

Stiles, Shahan and Davis (1933) recorded a case of coccidioidal granuloma in a heifer born and raised in Colorado but a complete residence history and the origin of the feed was not available.

Lynch (1920) reported a case of coccidioidal granuloma from Charleston, South Carolina. The patient, a Negress, had lived her entire life on an island off the coast of South Carolina and in Charleston. However, the fact that no additional cases have been recorded in this area suggests that she may have acquired the infection from contaminated material originating in California, Arizona, or Texas.

McDonald (1934) reported a case of coccidioidal granuloma from Louisiana. She stated that the patient had spent his entire life in that state except for nine months of World War service, four months of which was overseas. However, she did not state where the other five months of service were spent.

Our discussion has included only reports of cases which might provide information regarding the distribution of *C. immitis* in nature. While these cases would indicate that *C. immitis* is fairly widely distributed in the United States, the residence histories are not adequate and additional cases must be proven before other endemic areas can be established. Schenken and Palik (1942) have summarized much of the literature on cases reported in areas of the United States other than California.

South America

Four cases of coccidioidal granuloma have been recorded in South America. Posadas (1892) and Mazza and Parodi (1927) reported two cases and Niño (1938) summarized the information on two additional cases, all of which occurred in the Chaco region of Argentina. Cases of coccidioidal granuloma reported from Brazil are paracoccidioidal granuloma (see p. 214).

Europe

Hartmann and Schoo (1912), working in Holland, published an autopsy report on a patient said to have died of cancer, who may have had coccidioidal granuloma. If this case could be verified, it would be the first case to be reported from Europe. Ciferri and Redaelli (1936) and the authors consider the diagnosis of coccidioidal granuloma open to question. Redaelli and Ciferri (1934) have reviewed the data on the European cases. They mentioned three cases occurring in Naples, Italy. The fungus isolated from one of these cases was described as *Glenospora meteuropea* by Castellani and Jacono (1933), but was shown by Redaelli and Ciferri (1934) and Ciferri and Redaelli (1936) to be *C. immitis*. They also mentioned another patient from the Balkans from which Castellani and Jacono isolated *Glenospora meteuropea* but indicated that this culture was not *C. immitis*. In 1939 we received a culture from Redaelli labeled: "*Coccidioides immitis* var. *meteuropeus* (= *Glenospora metaeuropeus* Castellani) (culture originally from Castellani, of Balkan origin)." This culture (our number 28) is definitely *C. immitis*, but whether it is a subculture of the Balkan culture of *Glenospora metaeuropeus*, which Ciferri and Redaelli stated is not *C. immitis*, is of course, uncertain. Redaelli and Ciferri also mentioned a case originating in Hamburg, Germany, but stated that the diagnosis is doubtful.

Other Areas

Redaelli and Ciferri discussed a patient from Australia who appeared to have acquired the infection from California vegetables. They pointed out that this case needs verification. They gave no references to the original reports of the Hamburg and Australian cases and we have been unable to find any reference to them in the literature.

Fennel (1935) reported a case in Hawaii. The patient, a full-blooded Hawaiian, had never been out of the islands. The author discussed the possibility of the introduction of the fungus into this area by means of fresh vegetables from California. Additional cases will have to be recorded in Hawaii before it can be considered an endemic area.

There are a few reports of cases of coccidioidal granuloma from other areas, but a critical examination of the data makes it apparent that the investigators were mistaken in their identification of the organism. For example, Chou and Reiss (1931) reported a case of coccidioidal endoophthalmitis from China. Examination of the figures makes it quite

evident that the investigators were dealing with some other fungus. Burgess (1929) reported coccidioidal granuloma in a patient from Montreal, Canada, whose infection he attributed to handling fresh vegetables from California. However, he was unable to obtain cultures, and his description of the clinical aspects and of the parasite are not convincing.

The distribution of *C. immitis* (and coccidioidomycosis) may be summarized as follows: Endemic areas occur in the southern half of California, particularly in the San Joaquin Valley, and in certain parts of Arizona and Texas. Possibly other endemic areas exist in the United States, but the evidence is insufficient for any definite conclusions to be made. Outside of the United States it seems likely that an endemic area exists in South America (Argentina) and possibly in Italy (Naples).

SUMMARY

The gross morphology of fifteen strains of *Coccidioides immitis* Rixford and Gilchrist 1896 was studied in single spore culture on potato dextrose, Sabouraud's and synthetic agars. Cultures of single strains on a given medium were quite constant but there was considerable difference in the gross morphology of the same strains on the three media. There was considerable variation in the gross morphology of the different strains when cultured on the same medium. Incubation of cultures in either light or dark had no effect on the gross morphology.

The microscopic morphology of the same strains was studied both in animal tissues and in culture. There was remarkable similarity in the morphology in animal tissues of all of the strains. In culture the similarity was somewhat less but the differences are quantitative rather than qualitative and are not considered of taxonomic significance. A discussion of the life cycle of this fungus was given.

The taxonomic position of the genus *Coccidioides* Rixford and Gilchrist 1896 was discussed and a description given on the basis of present information. It was suggested that this fungus is a Phycomycete and may be related to members of the Protomycetaceae. It was concluded that the genus is represented by the single species, *Coccidioides immitis* Rixford and Gilchrist 1896.

The distribution of *Coccidioides immitis* Rixford and Gilchrist 1896 was discussed. It was concluded that endemic areas exist in California, Arizona, and Texas in the United States, the Chaco region of Argentina and possibly in Italy.

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EXPLANATION OF PLATE I.

Coccidioides immitis. Photographs of fifteen strains.

Fig. 1. Cultures on potato dextrose agar.
Fig. 2. Cultures on Sabouraud's agar.

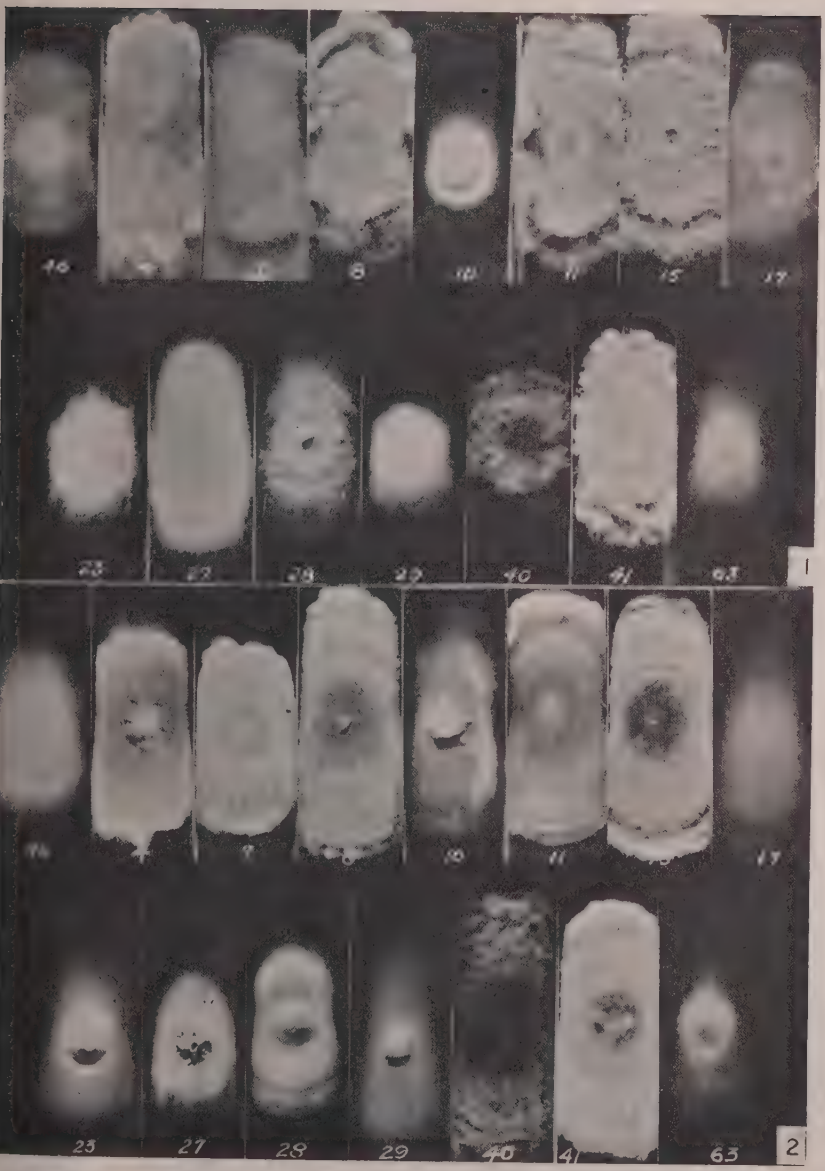


PLATE I.

EXPLANATION OF PLATE II.

Coccidioides immitis. With the exception of figure 1, all figures are of strain 46 and are shown at a magnification of × 495.

Fig. 1. Photograph of fifteen strains cultured on synthetic agar.
Fig. 2. Mature spherule containing endospores. Section of guinea pig testis stained with Harris' hematoxylin.
Fig. 3. Small spherule within a histiocyte. Section of guinea pig testis stained with Harris' hematoxylin.
Fig. 4. Spherule with large vacuole. Macerated mouse lung mounted in cotton blue lacto-phenol.
Fig. 5. Spherule showing first cleavage plane. Macerated mouse lung mounted in cotton blue lacto-phenol.
Fig. 6. Spherule showing early stages of cleavage. Macerated mouse lung mounted in cotton blue lacto-phenol.
Fig. 7. Spherule showing early stages of cleavage. Macerated mouse lung mounted in cotton blue lacto-phenol.
Fig. 8. Large spherule (about 80 μ in diameter) in which no spores have formed. Macerated mouse lung mounted in cotton blue lacto-phenol.
Fig. 9. Spherule with peripherally arranged protoplasm cut by radial cleavage planes. Macerated mouse lung mounted in cotton blue lacto-phenol.
Fig. 10. Large spherule with many small, irregular spores. Macerated mouse lung mounted in cotton blue lacto-phenol.
Fig. 11. Spherule with large eccentric vacuole. Macerated mouse lung mounted in cotton blue lacto-phenol.

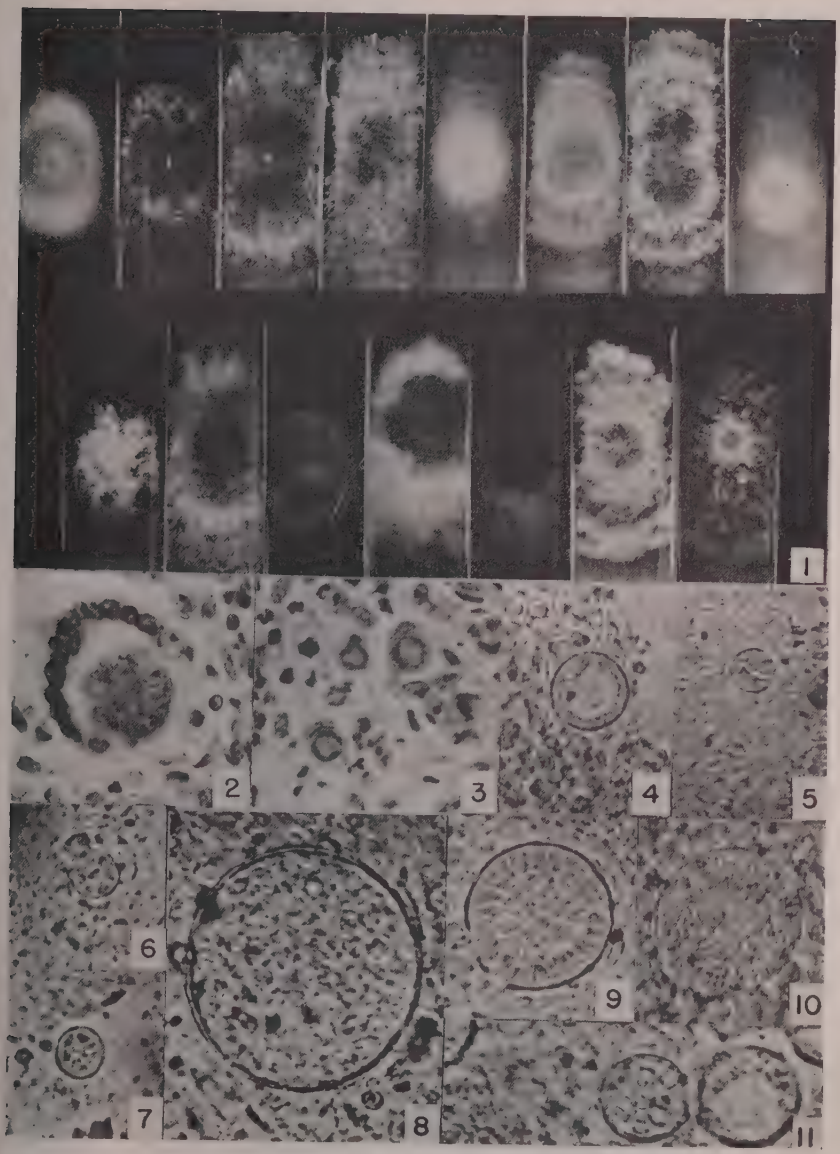


PLATE II.

EXPLANATION OF PLATE III.

Coccidioides immitis. Figures 1 and 9–18 are of strain 46, figures 3–8 are of strain 40, and figure 19 is of strain 4; all are at a magnification of × 495.

Fig. 1. Spherule with large endospores. Macerated mouse lung mounted in cotton blue lacto-phenol.

Fig. 2. Club-like processes radiating from the cell wall. Section of a mediastinal lymph node of a cow stained with Harris' hematoxylin.

Fig. 3. Dumbbell-shaped structure resembling conjugation. Pus from guinea pig testis mounted in cotton blue lacto-phenol.

Fig. 4. Two spherules apparently joined, resembling conjugation. Note the apparent evagination into one spherule. Pus from guinea pig testis mounted in cotton blue lacto-phenol.

Fig. 5. Spherule with three large endospores. Pus from guinea testis mounted in cotton blue lacto-phenol.

Fig. 6. Three spherules, two containing endospores, joined by short tubes suggestive of conjugation. Two spherules, one containing endospores, joined by a tube suggestive of conjugation. Pus from guinea pig testis mounted in cotton blue lacto-phenol.

Fig. 7. Large spherule containing three large endospores joined to a smaller spherule by a narrow tube. Suggestive of conjugation. Pus from guinea pig testis mounted in cotton blue lacto-phenol.

Fig. 8. Two spherules containing endospores joined and with an opening between them. Pus from guinea pig testis mounted in cotton blue lacto-phenol.

Fig. 9. Spherule with fine spine-like excrescences radiating from the cell wall. Section of guinea pig testis stained with Harris' hematoxylin.

Fig. 10. Dumbbell-shaped structures and cells joined by a tube. From an old culture. Mounted in cotton blue lacto-phenol.

Fig. 11. Germinating endospore showing first branch. Unstained.

Fig. 12. Germinating endospore. Unstained.

Fig. 13. Germinating endospore showing branching and septation of germ tube. Unstained.

Fig. 14. Endospores in a large spherule germinating through the spherule wall. Unstained.

Fig. 15. Mycelium in a four day old slide culture. Mounted in cotton blue lacto-phenol.

Fig. 16. Mycelium in a four day old slide culture. Mounted in cotton blue lacto-phenol.

Fig. 17. Clavate cells from a one month old culture. Mounted in cotton blue lacto-phenol.

Fig. 18. Chain of chlamydospores interspaced by empty hyphal spaces. From one month old culture. Mounted in cotton blue lacto-phenol.

Fig. 19. Spindle-shaped chlamydospores from a one month old slide culture. Stained in 1% aqueous cotton blue.

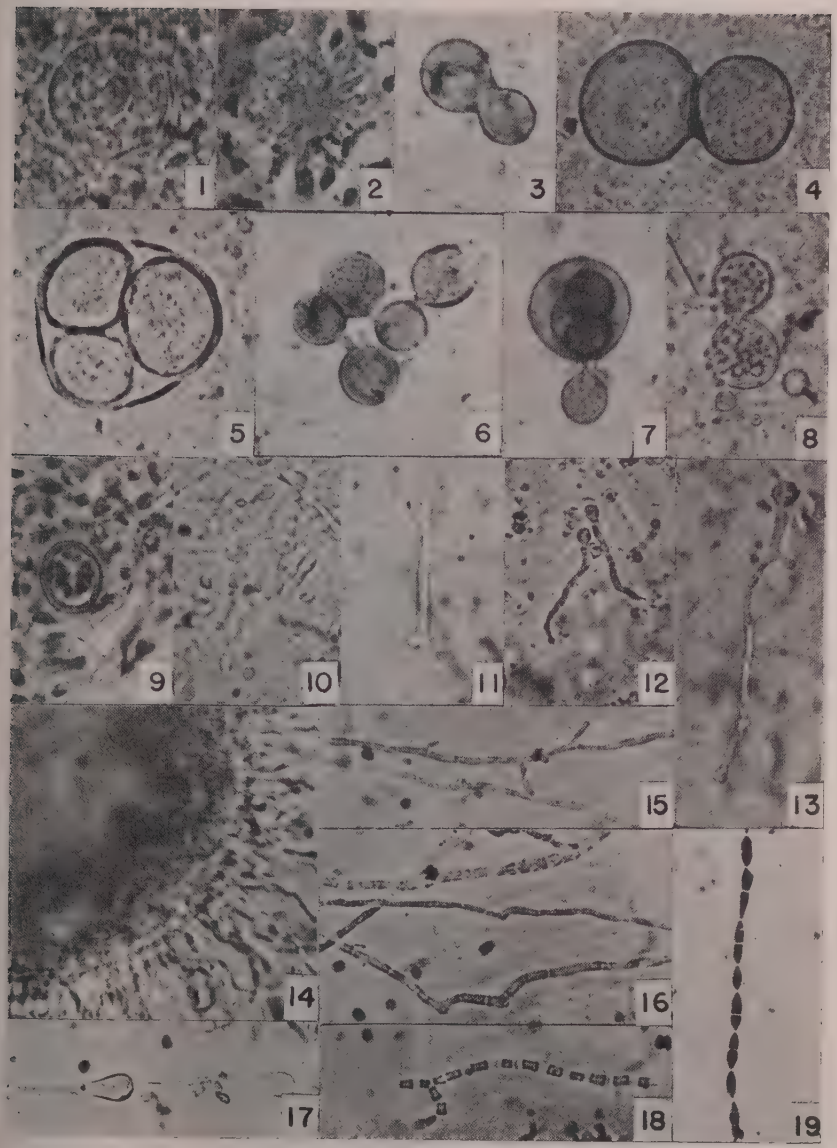


PLATE III.

EXPLANATION OF PLATE IV.

Coccidioides immitis. Figures 1–3 and 8–12 are of strain 4; figures 4–7 and 13–14 are of strain 46. Figures 1–12 are shown at a magnification of × 495, 13–14 at × 1800.

Fig. 1. Chain of chlamydospores interspaced by empty hyphal spaces. From a one month old slide culture. Stained in 1% aqueous cotton blue.
Fig. 2. Chain of chlamydospores containing both spherical and cylindrical spores from a one month old slide culture. Stained in 1% aqueous cotton blue.
Fig. 3. Spherical chlamydospores from a one month old slide culture. Stained in 1% aqueous cotton blue.
Fig. 4. Chain of oidia from a month old slide culture. Mounted in cotton blue lacto-phenol.
Fig. 5. Germinating chlamydospore. Unstained.
Fig. 6. Germinating chlamydospore. Unstained.
Fig. 7. Terminal culture spherule with one cleavage plane. Mounted in cotton blue lacto-phenol.
Fig. 8. Early stage of zygospore-like structure. Slide culture stained with 1% aqueous cotton blue.
Fig. 9. Early stage of zygospore-like structure. Slide culture stained with 1% aqueous cotton blue.
Fig. 10. Later stage of zygospore-like structure. Slide culture stained with 1% aqueous cotton blue.
Fig. 11. Later stage of zygospore-like structure. Slide culture stained with 1% aqueous cotton blue.
Fig. 12. Zygospore-like structure with thick wall. Slide culture stained in 1% aqueous cotton blue.
Fig. 13. Nuclei in germinating chlamydospores. Stained with iron hematoxylin.
Fig. 14. Nuclei in germinating chlamydospores. Stained with iron hematoxylin.

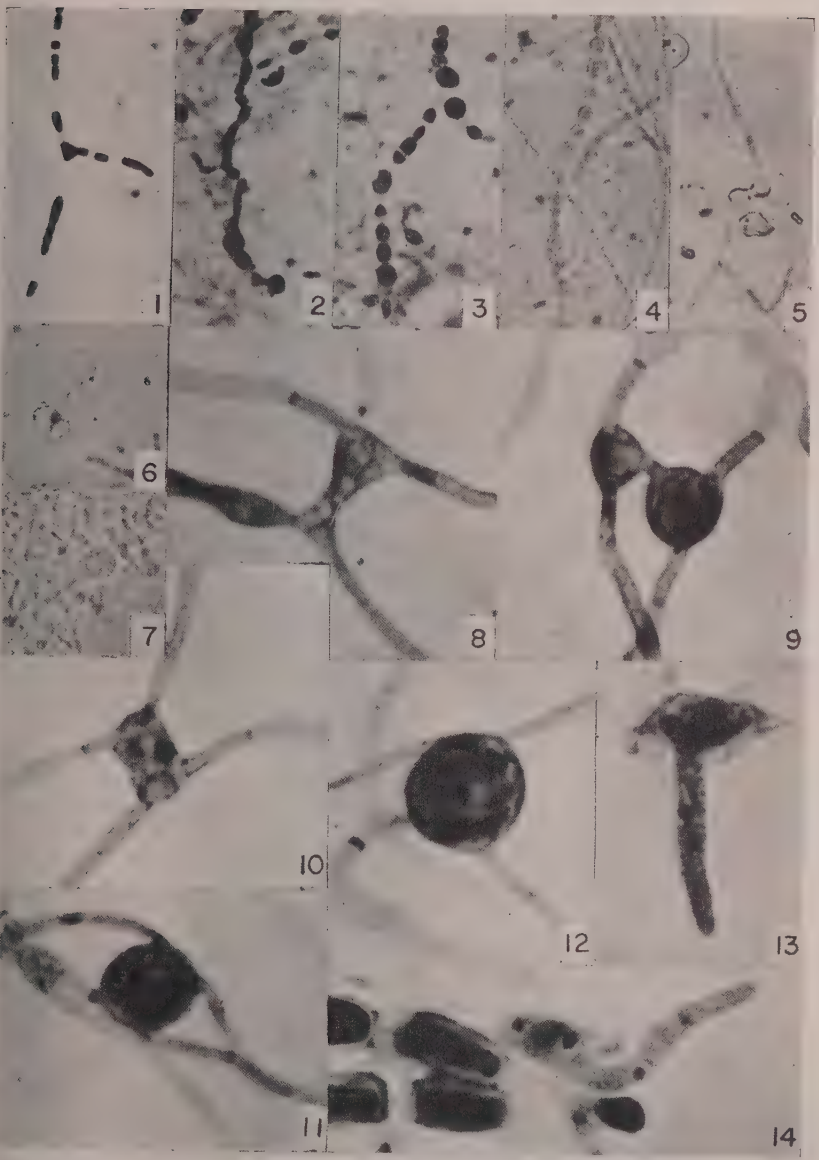


PLATE IV.

EXPLANATION OF PLATE V.

Coccidioides immitis. All figures are of strain 46 and at a magnification of × 1800.

Fig. 1. Nuclei in germinating chlamydospores. Stained with iron hematoxylin.
Fig. 2. Large spherule showing nuclei. Stained with Flemming's triple stain.
Fig. 3. Large spherule showing nuclei. Stained with Flemming's triple stain.

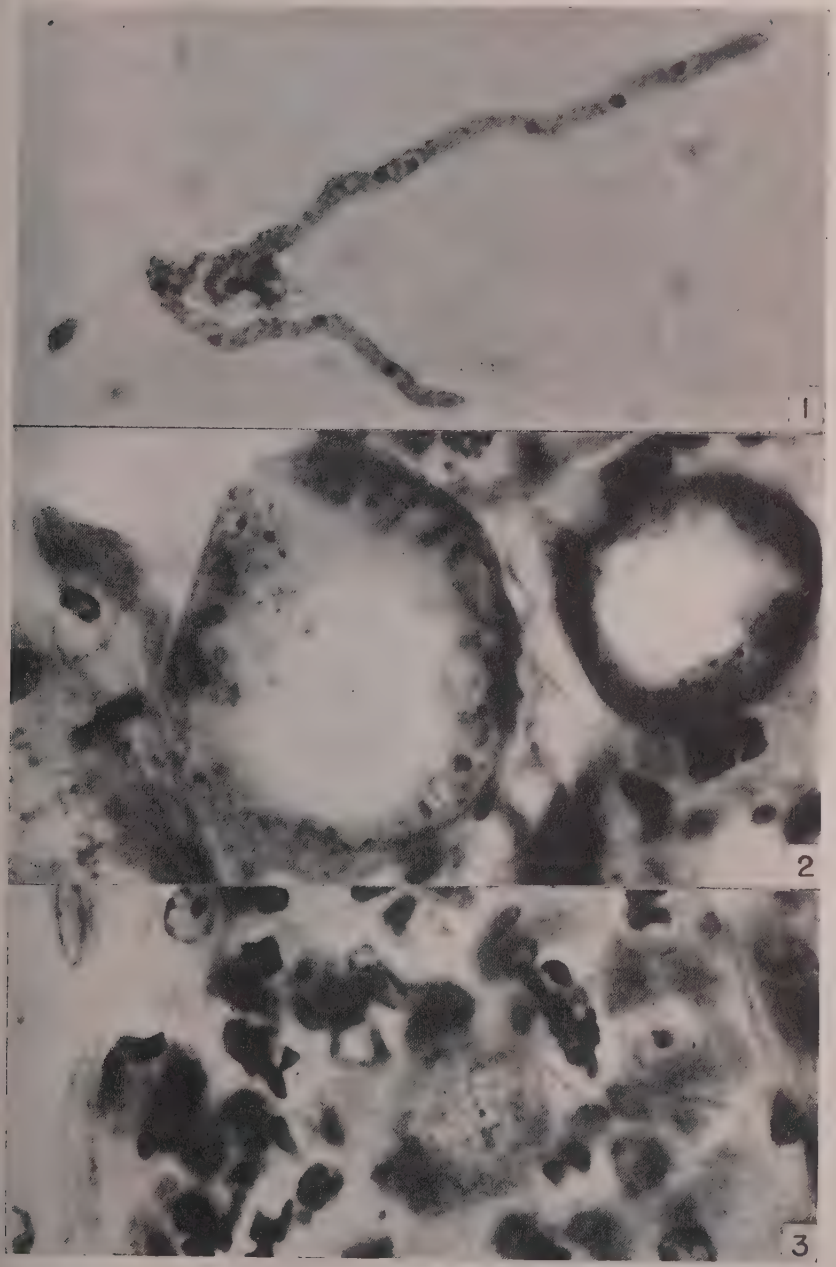


PLATE V.

EXPLANATION OF PLATE VI.

Coccidioides immitis. All figures are of strain 46 and shown at a magnification of × 1700.

Fig. 1. Recently released endospore (or small spherule) containing two nuclei. Stained with Flemming's triple stain.

Fig. 2. Small spherule showing two dividing nuclei. Stained with Flemming's triple stain.

Fig. 3. Small spherule with four nuclei. Stained with Flemming's triple stain.

Fig. 4. Small spherule with eight nuclei. Stained with Flemming's triple stain.

Fig. 5. Small spherule with eleven nuclei. Stained with Flemming's triple stain.

Fig. 6. Large spherule with a central vacuole and with numerous nuclei in the peripheral cytoplasm. Stained with Flemming's triple stain.

Fig. 7. Large spherule with protoplasm cut up into irregular multinucleate segments. Stained with Flemming's triple stain.

Fig. 8. Mature spherule containing uni- to multinucleate endospores. One endospore contains one dividing nucleus. Stained with Flemming's triple stain.

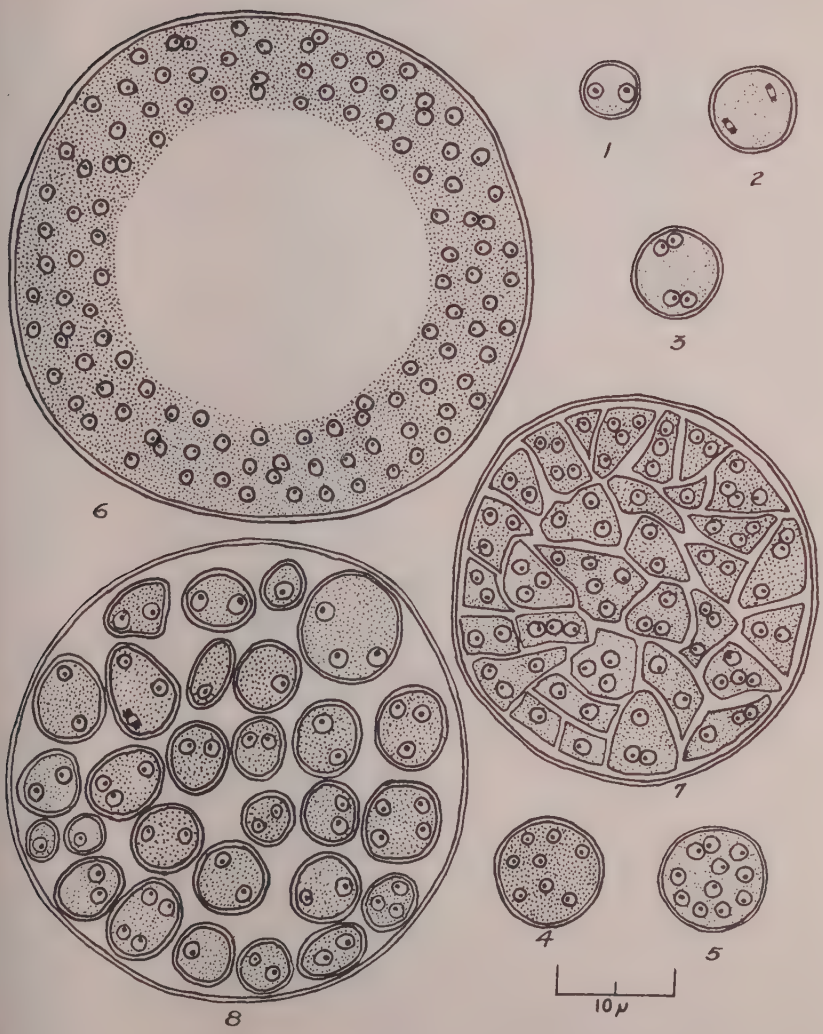


PLATE VI.

EXPLANATION OF PLATE VII.

Coccidioides immitis. All figures are of strain 46 and are shown at a magnification of × 1700.

Fig. 1. Germinating chlamydospore with a single dividing nucleus. Stained with iron hematoxylin.
Fig. 2. Uni- and binucleate hyphal cells of young culture. Stained with iron hematoxylin.
Fig. 3. Uni- and binucleate hyphal cells of young culture. Stained with iron hematoxylin.
Fig. 4. Uni- and multinucleate chlamydospores. Stained with iron hematoxylin.
Fig. 5. Uni- and binucleate chlamydospores. Stained with iron hematoxylin.
Fig. 6. Binucleate spherical chlamydospore. Stained with iron hematoxylin.
Fig. 7. Spherical chlamydospores with four nuclei. Stained with iron hematoxylin.
Fig. 8. Spherical chlamydospore with eight nuclei. Stained with iron hematoxylin.

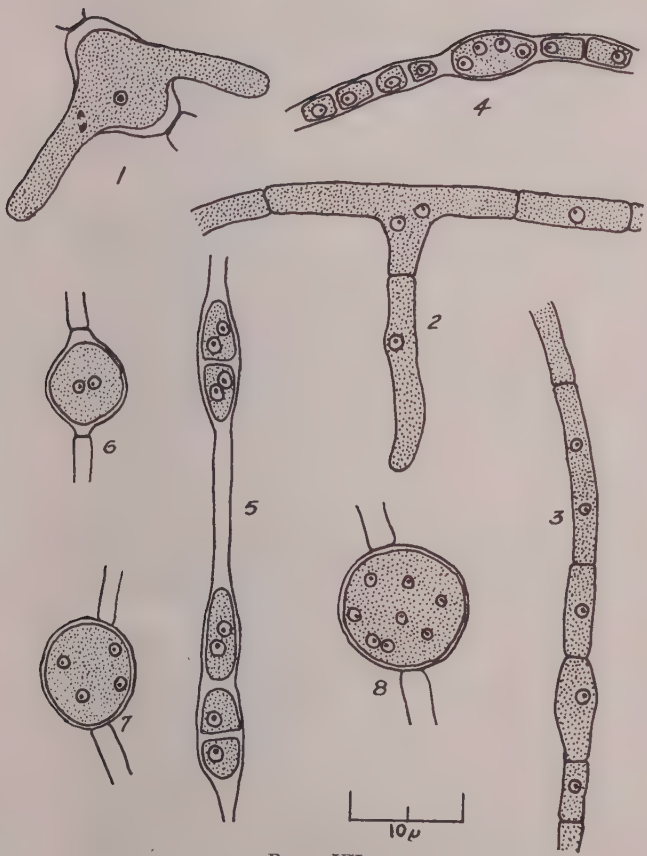
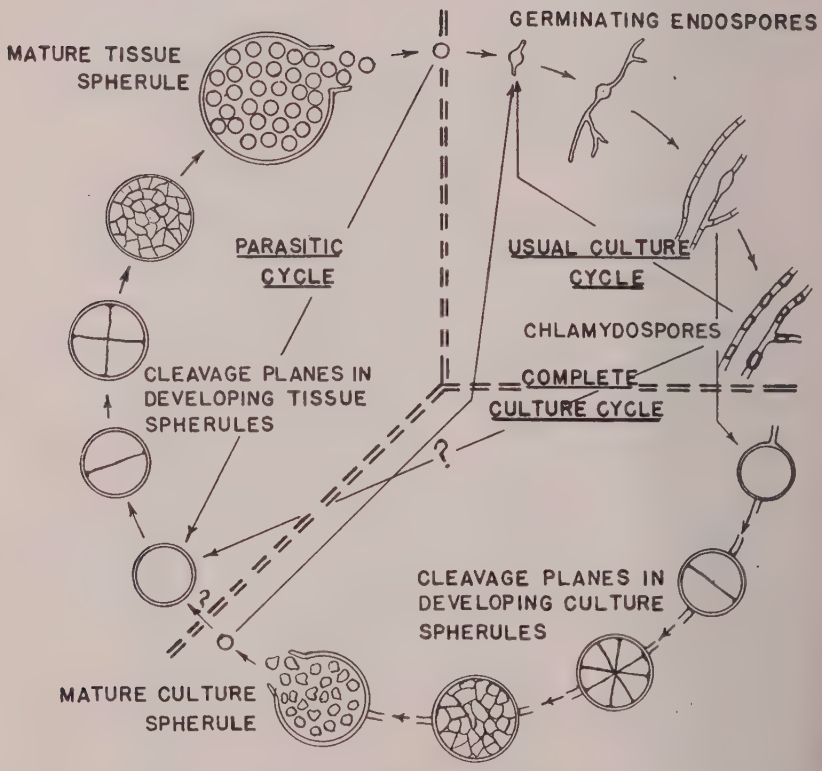


PLATE VII.



LIFE CYCLE

OF

COCCIDIOIDES IMMITIS RIXFORD AND GILCHRIST 1896

PLATE VIII.

1 (2) : 245–262 FARLOWIA July, 1943

AN INDEX TO RAFINESQUE'S PUBLISHED TECHNICAL NAMES FOR THE CELLULAR CRYPTOGAMS [1]

E. D. Merrill

Somewhat over a year ago I located an entirely overlooked botanical paper[2] published by Rafinesque in 1834. This contained a considerable number of validly published generic and specific names, none of which had even been listed in our standard indices. An examination of other works published by Rafinesque indicated also that some of these had never been indexed, while here and there in works that had been indexed other overlooked technical names were found. These findings impressed me with the desirability of preparing and publishing a comprehensive Index Rafinesquianus, chiefly because of the homonym rule in the International Code of Botanical Nomenclature. After the lapse of more than a century it did seem to be desirable at least to list the Rafinesque names; this task should have been done a half century earlier.

When the slips were prepared, approximating 12,000, those appertaining to the vascular cryptogams and the cellular cryptogams were segregated. The first study was devoted to the vascular crytogams wherein I attempted to determine the actual status of each generic name and each binomial.[3] The present paper is devoted to a consideration of the names proposed by Rafinesque for the cellular cryptogams, but unlike his names for the ferns, I have, in general, in the algae, fungi, lichens, and mosses, not attempted to determine the status of the various entities. The final study will be a consideration of the very numerous entries appertaining to the phanerogams, but this will be a time-consuming task and may not be completed for a year or two. In the meantime it was thought to be worth while to prepare a list of those names, most of them entirely overlooked for more than a century, appertaining to the cellular cryptogams, and to publish it in a place where it would be available to specialists concerned with a study of these groups. In the cellular cryptogams it is chiefly the algae and the fungi that are involved, for Rafinesque's contributions to the elucidation of the other major groups were fortunately slight.

With few exceptions Rafinesque's descriptions of his numerous new genera and new species of cellular cryptogams are short, vague, indefinite, and hence highly unsatisfactory. Yet his names, as far as he prepared and published descriptions for his proposed entities, are validly published under all accepted rules of nomenclature, and should at least be listed. Most of the names that he proposed for the cellular cryptogams

[1] The publication of this article out of order of receipt is made possible through a grant from the Arnold Arboretum.

[2] **Merrill, E. D.** A generally overlooked Rafinesque paper. Proc. Am. Philos. Soc. **86**: 72–90. 1942; see also **Merrill, E. D.** Rafinesque's work from the standpoint of world botany, op. cit. 1943. (*In press.*)

[3] **Merrill, E. D.** New names for ferns and fern allies proposed by C. S. Rafinesque, 1808–1838. Am. Fern Jour. **33**: 41–56. 1943.

have been overlooked by succeeding botanists concerned with the study of the algae, fungi, lichens, and mosses. In the following list the hitherto overlooked Rafinesque names are marked with an asterisk. In such bibliographic work as I have been able to accomplish in a field in which I am not qualified to work as a specialist, I have noted less than forty names in all categories, that have ever been cited by specialists. In checking Rafinesque's names I must admit, however, that my bibliographic work has scarcely exceeded the consultation of certain standard indices, such as the Gesamtregister zum I Teil of the first edition of Engler and Prantl's Die Natürlichen Pflanzenfamilien (1909), the indices to the few volumes of the second edition of that work that have been issued appertaining to the cellular cryptogams (1924–1938), the indices to Saccardo's Sylloge Fungorum, and Mussat's "Synonymia generum specierum subspecierumque in Vol. I–XIV descriptorum" Syll. Fung. **15:** i–viii. 1–455. 1901.

Of a total of about three hundred eighty new names in all categories proposed by Rafinesque for all groups of cellular cryptogams, about three hundred forty fall in the group of hitherto overlooked ones. In the list of generic names proposed by Rafinesque as new, totalling about one hundred thirty-four, only about thirty-one seem ever to have been mentioned or reduced to synonymy by Rafinesque's successors. Almost no attention has been given to his proposed new species. The percentage of overlooked Rafinesque names for the cellular cryptogams is very much higher than is the case for the phanerogams, clearly indicating that the specialists in the classification of algae and fungi have rather generally ignored Rafinesque's crude attempts at taxonomic work in these groups. Any specialist who will familiarize himself with Rafinesque's very short, generalized, and totally inadequate descriptions will probably agree to the general proposition that it is impossible safely to place most of his entities in synonymy or otherwise.

These lists have been prepared not with the idea that any specialist may be intrigued with attempting to determine the status of the many inadequately characterized genera and species, but as indicated above, because of the accepted homonym rule. It is realized that the conservative botanist will disapprove this bibliographic attempt in his belief that nothing that Rafinesque published in botany is worthy of consideration. Yet this attitude does not obviate the fact that the homonym rule is official, and that no matter how bad Rafinesque's descriptions usually are, *his validly published names* must be considered. It is difficult to see how a valid argument against listing Rafinesque's names can be supported, no matter how gladly this or that botanist would eliminate them. Under the homonym rule should a modern botanist select a generic name or a binomial that had been proposed and validly published by Rafinesque over a century ago for one entity, and apply the same name to the entity that he considers to be new, then the later name would be invalid and would have to be changed. The modern taxonomist should be able to determine whether

or not a certain name has been previously used, but until such names are at least listed, he has no way of doing this. He should not be penalized merely because those bibliographers concerned with the compilation of comprehensive indices have, in the past, overlooked a considerable number of Rafinesque's published works. As to generic names, there is, of course, the principle of *nomina generica conservanda* that may be invoked to preserve later homonyms, but additions to this already long list requires appropriate action from some properly constituted International Botanical Congress. There is no method of eliminating properly published binomials. Because of the approved beginning dates for the names of the fungi (1821–32, Fries' Systema mycologicum) for other than the Uredinales, Ustilaginales, and the Gasteromycetes, probably many of Rafinesque's proposed new genera may safely be ignored.

No matter what one may think of the character of Rafinesque's work and no matter if one would prefer that all of Rafinesque's numerous botanical publications should be officially outlawed, only an International Botanical Congress can take such action; and in the past only a few published works have been officially banned. One illustration of a botanical taboo is Gandoger's Florae Europae, which was officially eliminated[1]; and I suspect that the chief reason for this action was that Gandoger's work appeared in the form of lithographed handwriting rather than actually printed; but all of Rafinesque's published works were printed. As long as such action has not been taken in reference to Rafinesque's botanical publications his work will have to be accepted and specialists will have to do the best that they can with his descriptions. My personal opinion is that no matter how unorthodox and how poor an individual author's work may be, the official banning of the work of this or that author is extremely dangerous.

In this paper no serious attempt has been made to determine the status of Rafinesque's proposed genera and species for the cellular cryptogams, as I did for the vascular cryptogams, for in the groups covered I do not consider myself competent to express opinions except in manifestly clear cases. I do feel, however, that with judicious field work in the neighborhood of Palermo, Sicily, a competent algologist could place a considerable number of Rafinesque's new genera and species of algae; and this in spite of the short and usually inadequate descriptions, and as far as he illustrated his species, the very poor figures. In the algae I note that several of the Rafinesque entities that he definitely placed in that group, actually represent organisms in the animal kingdom. Thus *Pexisperma lutescens* Raf., as figured by him, is an alconyrian coral, probably a *Paragorgia; Phytelis radiata* Raf. may represent a large species of *Nummulites; Helmyton spiralis* Raf. might be a species of *Spirobus* or a

[1] **Gandoger, M.** Flora Europae terrarumque adjacentium; sive. Enumeratio plantarum per Europam atque totam regionem mediterraneam cum insulis atlanticis sponte crescentium, novo fundamento instauranda. Paris. 27 volumes in 13, 1883–91.

Serpicula; Siphytus obconicus Raf. probably represents a hydroid, and *S. alternus* Raf. is definitely a plumularian hydroid; *Chledipole tubulosa* Raf. apparently represents a species of sponge, and *Myrsidrum clavatum* Raf. might belong in the same general group of animals. It is only fair to Rafinesque to note that he considered the Corallina and the Spongidia to represent algae, placing them in his group III Fucidia in the Algosia (Algae) in his scheme of classification (see Rafinesque, Anal. Nat. Tabl. Univ., pp. 206–209. 1815). Rafinesque's descriptions of the algae are so short and so generalized that sometimes one can scarcely say what major group is represented: the Chlorophyceae, Phaeophyceae, or Rhodophyceae.

The situation in reference to Rafinesque's numerous new genera and species of fungi is scarcely more promising than it is with the algae, and for the same reasons, although here illustrations of some of his species exist. In his Life of Travels, p. 45. 1836, Rafinesque states that he undertook a voyage from Sicily to the United States in 1815, taking passage on the "Union of Malta" to New York, and taking with him most of his fortune and collections:

> "50 boxes containing my herbal, cabinet, collections and part of my library. I took all of my manuscripts with me, including 2000 maps and drawings, 300 copper plates, &c. My collection of shells was so large as to include 600,000 specimens large and small. My herbal was so large that I left a part of it."

This material was all lost in Rafinesque's shipwreck off Fishers Island near New London, Connecticut, November 2, 1815. Rafinesque did, however, later receive from Palermo a set of proofs of a part of the illustrations included on the 300 copper plates mentioned above. These he presented to the New York Lyceum of Natural History, and they are now preserved in the library of the New York Botanical Garden. This partial set is the only known extant copy.

Mr. W. R. Gerard[5] examined these proofs in 1885 and states that this New York set consists of twenty-nine plates on which figures of forty-six new genera and new species of North American plants appear; these illustrations were based on specimens collected or observed by Rafinesque while he was a resident of Philadelphia, 1802–04. Mr. Gerard lists the names on these figures verbatim. Thirty-one of the figures represent fungi, and the remainder flowering plants. Regarding the fungus figures, Gerard states:

> "Most of the figures of fungi seem to have been drawn from memory—possibly from imagination, and all are quite crudely executed. Those relating to known genera bear only a remote resemblance to the objects they were designed to illustrate, and not one could possibly be of aid in the determination of a species. . . ."
> "The small collection of plates is perhaps of interest in connection with the bibliography of American botany, and as unique relics of one of its earliest, as well as one of its most eccentric students. The figures of flowering-plants may be of use

[5] **G[erard], W. R.** Reliquiae Rafinesquianae. Bull. Torr. Bot. Club **12**: 37–38. 1885.

in helping to elucidate the author's vague descriptions, but the plates of the fungi will only serve to show what a useless mass of rubbish would certainly have been inflicted upon mycological science had not the fortunate shipwreck of 1815 intervened."

However, in passing, it is well to note that all of the new genera and most of the species of fungi that Rafinesque attempted to illustrate on these lost plates, had already "been inflicted upon mycological science" for their technical descriptions had been published previous to Rafinesque's loss of the plates in 1815. In listing Rafinesque's genera and species of fungi I have included references to those names appearing in Gerard's list.

Rafinesque originated seventy-four new generic names for various groups of fungi that he considered to be new, or, in a very few cases, where he proposed new names for genera previously designated by other authors under names that he did not approve. Until very recently, I judge that the mycologists have largely ignored these proposed new genera. In 1933, however, Fischer, in Engler & Prantl, Nat. Pflanzenfam. ed. 2, **7a:** 84, 1933, actually recognized one of Rafinesque's generic names as valid, when he accepted *Colonnaria* Raf. (1808) as the designation of a certain group of fungi which he segregated from *Clathrus* (Micheli) Pers. He gives the synonymy as *Laternia* auctt. in part, and *Linderia* G. H. Cunningham (1931). On what inadequate data most of Rafinesque's generic entities in the fungi must be interpreted is illustrated by the following very inadequate original descriptions, the only ones of *Colonnaria* published by him: "Colonnaria (urceolata, truncata, &c) divided into four pillars, united at the top, which bear the seeds in the margins. Found in Penn." (Med. Repos. II **5:** 355. 1808). In the following year this was translated into French and published thus: "5. Colonnaria *urceolata, truncata;* dividée en quatre piliers réunis par le sommet, portant les semences sur leurs bords. Se trouve en Pensilvanie." (Jour. Bot. (Paris) **2:** 176. 1809).

Incidentally, crude figures of both of these species of *Colonnaria* exist in the unique set of proofs of Rafinesque's lost copper plates, now preserved in the library of the New York Botanical Garden. Gerard[6] comments on these crude illustrations as follows:

"As for the figures of *Colonnaria*, they bear a general resemblance to *Laternea columnata*, in that they have a receptacle composed of four branches united at the top and base; but here the analogy ends, for *C. truncata* is surmounted by a perfectly square, sharp-cornered, open box, full as wide as the lower extremity of the fungus, and the edge of which is decorated with what looks like a cylindrical moulding. The other species, *C. urceolata*, has somewhat the same habit, but differs in the substitution of a wide circular ring or collar for the "box"—its edge likewise being finished off with the ornamental moulding. The species of neither of the genera [*Aedycia* Raf. and *Columnaria* Raf.] are provided with a volva, and both of those in the last-mentioned genus [*Colonnaria*] remind me very strongly of certain quaint objects which I have seen in collections of Japanese ceramics. I venture to say that no so absurd fungi as these ever were, or ever will be, found on the face of the earth."

[6] G[erard], W. R. op. cit. 38.

With this indictment of Rafinesque's own figures of his two species of *Colonnaria*, one wonders if Fischer used good judgment in accepting *Colonnaria* Raf. (1808) as a valid generic name, with the sinking of *Linderia* G. H. Cunningham (1931) in its synonymy. Incidentally, Gerard states on the preceding page that most of Rafinesque's figures of fungi "seem to have been drawn from memory — possibly from imagination —." As a phanerogamic botanist, were I dealing with a description of a flowering plant relatively as short and indefinite as that of Rafinesque's appertaining to *Colonnaria*, and not supported by extant specimens, my inclination would be to ignore the name, and in this case retain *Linderia* G. H. Cunningham; and yet, in spite of the extraordinary Rafinesque figures that Gerard discusses, the probabilities are very great that Rafinesque actually did have specimens of *Linderia* in mind when he wrote his very brief description of *Colonnaria*, and when he made his very crude and very inaccurate illustrations of the two species. In view of the universal acceptance of the name *Lindera* Thunb. (1783) for a genus of the Lauraceae, I believe that *Linderia* G. H. Cunningham (1931) is invalid, so perhaps after all Fischer should be followed in his interpretation of *Colonnaria* Raf.

The lichenologists and the bryologists fare much better than do the algologists and the mycologists. In the lichens Rafinesque proposed one new generic name, *Scyphorus* Raf. to replace *Scyphophorus* Ach., casually mentioned *Epidrolithus* which might be a lichen or possibly an alga or a fungus (Rafinesque merely states "a curious water lichen, rather than a Tremella" from which one suspects a species of *Leptogium*), and proposed but did not describe *Leptuberia amorpha*, "a small crustaceous lichen." He described only one moss, *Heterodon bryoides* Raf. The full description is: "Heterodon (bryoides) small moss with peristome 8-dentated, dentatures unequal. It grows in waters of New-Jersey." Short as this description is, it seems probable that *Heterodon* Raf. = *Fissidens* Hedwig, for *Fissidens* is about the only genus of mosses occurring in New Jersey that has aquatic representatives; yet as Mr. E. B. Bartram notes, the peristome of *Fissidens* has more than eight teeth. His only other venture in this group was to propose the new generic name *Diphas* (Raf., Am. Month. Mag. Crit. Rev. **1**: 429. 1817) to replace *Diphascum* Eaton (*Diphascium* Ehrh.).

In the following list, where Rafinesque's new names of cellular cryptogams are arranged alphabetically under the Algae, Fungi, Lichenes, and Musci, his apparently hitherto overlooked technical names are indicated by an asterisk. Where reductions are made, the authority is cited. Where only a name appears, without a description, the abbreviation *nom.* (*nomen nudum*) is added, and where descriptions were supplied, no matter how short, the corresponding abbreviation is *descr.* (*descriptio*). Where no technical descriptions were published, but brief comments are made which might supply a clue to the identity of a proposed genus or

species, the abbreviation *nom. subnud.* (*nomen subnudum*) is used. Where a Rafinesque description was repeated verbatim, when certain of his papers were republished in other periodicals, this repetition is indicated by the abbreviation *iter.* (*iteratio*); this does not apply to the series appearing in the Medical Repository, in English, which were republished in French in the Journal de Botanique. In those cases where Rafinesque published two different names for the same entity at the same time, as he frequently did, the abbreviation *nom alt.* (*nomen alternum*) indicates this for the alternate name. To avoid ambiguity between the two runs of the Journal de Botanique, in both of which Rafinesque's papers appear, the Journal de Botanique **1–2** (1808–09) and **1–4** (1813–16), the former is indicated as Jour. Bot. (Paris), and the latter as Jour. Bot. (Desv.), for the reason that inexperienced bibliographers not infrequently confuse the two. The first was entitled "Journal de botanique rédigé par une société de botanistes," and the second "Journal de botanique, appliquée a l'agriculture, a la pharmacie, a la médicine et aux artes." Both were published in Paris. Desvaux is indicated as the principal editor of the latter and probably also edited the former.

ALGAE[7]

***Acinaria** Raf., Jour. Phys. Chim. Hist. Nat. **89:** 107. 1819, *descr.; iter.*, Isis von Oken 1820, **1:** Lit. Anz. p. 243. 1820; Neogen. p. 4. 1825, *nom.* = *Chara* Linn.
*coccifera Raf., l. cc., *descr.*
*flexuosa Raf., l. cc., *descr.*
*latifolia Raf., l. cc., *descr.*
*salicifolia Raf., l. cc., *descr.*
Rafinesque's material was from the Ohio, Missouri, Mississippi, and Red Rivers. In his Neogenyton p. 4. 1825, he states that his *Acinaria*, with *Leiacina* Raf., belongs in the Characeae.

***Amasperma** Raf., Précis Découv. Somiol. p. 47. 1814. *descr.*; Jour. Bot. (Desv.) **4:** 273, 1814, *descr.;* Anal. Nat. Tabl. Univ. p. 209. 1815, *nom.*
*floculosa Raf., Précis Découv. Somiol. p. 47. 1814, *descr.*; Jour. Bot. (Desv.) **4:** 274. 1814, *descr.*
*monilia Raf., l. cc., *descr.*, Sicily.
*torulosa Raf., l. cc., *descr.*, Sicily.

Anevriton Raf., Specch. Sci. **2:** 167. 1814, *descr.;* Anal. Nat. Tabl. Univ. p. 208. 1815, *nom.*
*marginatum Raf., op. cit. p. 168, *descr.*, Sicily.

***Aporenia** Raf., Anal. Nat. Tabl. Univ. p. 209. 1815, *nom.*

Arthrodia Raf., Specch. Sci. **1:** 89. 1814, *descr.;* Anal. Nat. Tabl. Univ. p. 209. 1815, *nom.* = *Roya* W. & G. S. West (1896) fide Printz, *Closterium* Nitzsch., *sensu lat.*
*linearis Raf., l. c., *descr.*, Sicily.

***Bryonopsis** Raf., Specch. Sci. **2:** 89. 1814, *nom. nov.* = *Bryopsis* Lamouroux.

***Catenaria** Raf., Med. Repos. II. **5:** 351. 1808, *nom.;* Jour. Bot. (Paris) **2:** 168. 1809, *nom.*, non Sorokin.
*arenaria Raf., l. cc., *nom.*

[7]As noted in the introduction, those generic and specific names in these lists that are marked with an asterisk appear very generally to have been overlooked by students of the cellular cryptogams ever since they were published over a hundred years ago.

*concatenata Raf., l. cc., *nom.*
*vagabunda Raf., l. cc., *nom.*
The whole original statement is: "Catenaria, (arenaria, vagabunda, concatenata, &c.) intermediary between some *confervae* and *fuci.* On the sea shores." [Eastern United States.]

Ceramium Lyngbe.
*callithamnium Raf., Précis Découv. Somiol. p. 48. 1814, *descr.*, Sicily.
*opacum Raf., l. c., *descr.*, Sicily.
*squamosum Raf., l. c., *descr.*, Sicily.

Chantransia DC.
*dichlora Raf., Précis Découv. Somiol. p. 47. 1814, *descr.*; Jour. Bot. (Desv.) **4**: 273. 1814, *descr.*, Sicily.

Chara Linn.
*fetidissima Raf., Med. Repos. II. **5**: 354. 1808, *nom.*; Jour. Bot. (Paris) **2**: 174. 1809, *nom.* Eastern United States.
*patens Raf., l. cc. *nom.* Eastern United States.

Characias Raf., Anal. Nat. Tabl. Univ. p. 209. 1815, *nom. nov.* = *Chara* Linn.

***Chledipole** Raf., Car. Nuov. Gen. Sp. Sicil. p. 95. 1810, *descr.* = seq.
*lobata Raf., l. c., *descr.*, Sicily.
*tubulosa Raf., l. c. *t. 30. f. 10, descr.*, Sicily.

***Chledripole** Raf., Specch. Sci. **2**: 167. 1814, *nom.* = *Chledipole* Raf.

***Colophermum** Raf., Précis Découv. Somiol. p. 49. 1814, *descr.*; Jour. Bot. (Desv.) **4**: 275. 1814, *descr.*; Anal. Nat. Tabl. Univ. p. 209. 1815, *nom.*
*floccosum Raf., l. cc., *descr.*, Sicily.

Conferva (Linn.) Lagerh.
*isacella Raf., Précis Découv. Somiol. p. 46. 1814, *descr.*; Jour. Bot. (Desv.) **4**: 273. 1814, *descr.*, Sicily.

***Deloxus** Raf., Anal. Nat. Tabl. Univ. p. 208. 1815, *nom.*

***Deraphytus** Raf., op. cit. p. 209. *nom.*

Dictilema Raf., Précis Découv. Somiol. p. 48. 1814, *descr.*; Jour. Bot. (Desv.) **4**: 274. 1814, *descr.*; Anal. Nat. Tabl. Univ. p. 209. 1815, *nom.* = *Microdictyon* Decaisne (1839), fide Printz.
*glomerata Raf., Précis Découv. Somiol. p. 48. 1814, *descr.*; Jour. Bot. (Desv.) **4**: 274. 1814, *descr.*, Sicily.
*xanthosperma Raf., l. cc., *descr.* Sicily.

***Ecpexis** Raf., Atl. Jour. **1**: 200. 1833, *descr.*
*fluviatilis Raf., l. c., *descr.* Schuylkill River, Philadelphia.

***Ectosperma** Raf., Précis Découv. Somiol. p. 47. 1814, *nom.*; Jour. Bot. (Desv.) **4**: 274. 1814, *nom.*, non Vaucher.
*longiuscula Raf., l. cc., *descr.* Sicily.

***Ectospermia** Raf. Anal. Nat. Tabl. Univ. p. 209. 1815, *nom.* = *Ectosperma* Raf.

***Endonema** Raf., Anal. Nat. Tabl. Univ. p. 209. 1815, *nom.*

***Endosperma** Raf., Car. Nuov. Gen. Sp. Sicil. p. 91. 1810, *descr.*; Anal. Nat. Tabl. Univ. p. 208. 1815, *nom.*
*aggregata Raf., l. c., *descr.* Sicily.
*globosa Raf., l. c., *descr.* Sicily.

***Episperma** Raf., Précis Découv. Somiol. p. 48. 1814, *descr.*; Jour. Bot. (Desv.) **4**: 274. 1814, *descr.*
*micramnia Raf., l. cc., *descr.* Sicily.

***Helmyton** Raf., Car. Nuov. Gen. Sp. Sicil. p. 90. 1810, *descr.*
*glomeratum Raf., l. c., *descr.* Sicily.
*spiralis Raf., l. c., *t. 20 f. 7, descr.* Sicily. (Probably belongs in Vermes, *Serpicula.*)

***Isophlis** Raf., Car. Nuov. Gen. Sp. Sicil. p. 93. 1810, *descr.*
*concentricus Raf., l. c., *t. 20. f. 3, descr.* Sicily.

***Laminaria** Raf., Med. Fl. **2:** 221. 1830, *nom.* sub *Fucus*, non Lamx.
"Some sp. - - - are edible, such as F[ucus] edulis, dulcis, saccharinus, esculentus, palmatus, belonging in the N. G. *Laminaria*."

***Leiacina** Raf., Neogen. p. 4. 1825, *descr.* = *Chara* Linn.
*capitata Raf., l. c., *descr.* (*Chara capitata* Ell.) = *Chara capitata* Elliott.
*lucida Raf., l. c., *descr.* [Eastern United States].

***Leptorima** Raf. Car. Nuov. Gen. Sp. Sicil. p. 94. 1810, *descr.;* Anal. Nat. Tabl. Univ. p. 208. 1815, *nom.*
*nivea Raf., l. c., *descr.* Sicily.
*oculata Raf., l. c., *descr.* Sicily.
*undulata Raf., l. c. *t. 20. f. 4, descr.* Sicily.

***Lichiton** Raf., Specch. Sci. **2:** 168. 1814, *descr.*
*mamillaris Raf, l. c., *descr.* Sicily.
*phyteloides Raf., l. c., *descr.* (*Phytelis tuberculata* Raf.). Sicily.
*tuberculatum Raf., l. c., *descr.* Sicily.

***Merasperma** Raf., Med. Repos. II. **5:** 350. 1808, *descr.;* Jour. Bot. (Paris) **2:** 167. 1809, *descr.* = *Oxytrema* Raf. fide Raf., Jour. Phys. Chim. Hist. Nat. **89:** 107. 1819; *iter.*, Isis von Oken 1820, **1:** Lit. Anz. p. 243. 1820.
*bifurcata Raf., l. cc., *nom.* Pennsylvania.
*cylindrica Raf., l. cc., *nom.* Pennsylvania.
*dichotoma Raf., l. cc., *nom.* Pennsylvania.

***Mesasperma** Raf., Anal. Nat. Tabl. Univ. p. 209. 1815, *nom.* = *Merasperma* Raf.

***Myriosydrum** Raf., Anal. Nat. Tabl. Univ. p. 208. 1815, *nom.* = *Myrsidrum* Raf.

***Myrsidrum** Raf., Car. Nuov. Gen. Sp. Sicil. p. 97. 1810, *descr.*, non Bory.
*Bursa Raf., op. cit. p. 98, *descr.* (*Alcyonium Bursa* Linn.)
*clavatum Raf., l. c., *t. 20 f. 12, descr.* Sicily.
*dilatatum Raf., op. cit. p. 99, *descr.* Sicily.
*effusum Raf., op. cit. p. 98, *descr.* Sicily.
*ramosum Raf., l. c., *descr.* Sicily.
*vermilara Raf., l. c., *descr.* (*Lamarckia vermilara* Oliv., *Fucus fungosus* Desf., *Ulva tomentosa* Linn., *Fucus tomentosus* Spach). Sicily.

***Nemalectra** Raf., Neogen. p. 4. 1825, *descr.*
*calida Raf., l. c., *nom.* "in hot springs" [Eastern United States].
*fuscata Raf., l. c., *nom.*
*plumosa Raf., l. c., *nom.*

***Nostocus** Raf., Anal. Nat. Tabl. Univ. p. 208. 1815, *nom. nov.* [*Nostoc* Linn.].

***Opospermum** Raf., Précis Découv. Somiol. p. 48. 1814, *descr.;* Jour. Bot. (Desv.) **4:** 274. 1814, *descr.*
*nigrum Raf., l. cc., *descr.* Sicily.

***Orimanthis** Raf., Car. Nuov. Gen. Sp. Sicil. p. 95. 1810, *descr.;* Anal. Nat. Tabl. Univ. 208. 1815, *nom.*
*foliacea Raf., l. c., *descr.* Sicily.
*vesciculata Raf., l. c., *descr.* Sicily.

***Oxytrema** Raf., Jour. Phys. Chim. Hist. Nat. **89:** 107. 1819, *descr.; iter.*, Isis von Oken 1820, **1:** Lit. Anz. p. 243. 1820. [United States].

Pexisperma Raf., Car. Nuov. Gen. Sp. Sicil. p. 89. 1810, *descr.;* Anal. Nat. Tabl. Univ. p. 208. 1815, *nom.* = *Tetraspora* Link (1809) fide Printz.
*amplectens Raf., l. c., *descr.* Sicily.
*depressa Raf., Précis Découv. Somiol. p. 46. 1814, *descr.;* Jour. Bot. (Desv.) **4:** 273. 1814, *descr.* Sicily.
*dichrosperma Raf., Car. Nuov. Gen. Sp. Sicil. p. 89. 1810, *descr.* Sicily.
*lutescens Raf., l. c. *t. 20, f. 1, descr.* Sicily.
*sputo Raf., l. c. *t. 20. f. 2, descr.* Sicily.
*truncata Raf., l. c., *descr.* Sicily.

*__Phaxantha__ Raf., Car. Nuov. Gen. Sp. Sicil. p. 99. 1810, *descr.*; Anal. Nat. Tabl. Univ. p. 208. 1815, *nom.*
*lichenoides Raf., l. c., *descr.* Sicily.
*__Phoracis__ Raf., Car. Nuov. Gen. Sp. Sicil. p. 99. 1810, *descr.*; Anal. Nat. Tabl. Univ. p. 208. 1815, *nom.*
*filicina Raf., l. c., *descr.* Sicily. Regarding this, Rafinesque queries "an Fucus filicinus Jaq. Wulf. & Gmel.?"
*__Phycerus__ Raf., Specch. Sci. **2**: 168. 1814, *descr.*; Anal. Nat. Tabl. Univ. p. 209. 1815, *nom.*
*bifidus Raf., l. c., *descr.*, Sicily.
*__Phylictis__ Raf., Car. Nuov. Gen. Sp. Sicil. p. 91. 1810, *descr.*; Anal. Nat. Tabl. Univ. p. 208. 1815, *nom.*
*bifurcatus Raf., op. cit. p. 92, *descr.* Sicily.
*cervicornis Raf., l. c., *descr.* Sicily.
*cuneiformis Raf., l. c., *descr.* Sicily.
*dichotomus Raf., op. cit. p. 91, *descr.* Sicily.
*latifolius Raf., op. cit. p. 92, *descr.* Sicily.
*polypodioides Raf., l. c., *descr.* Sicily.
*subfistulosus Raf., l. c., *descr.* Sicily.
*undulatus Raf., l. c., *descr.* Sicily.
*__Physidrum__ Raf., Car. Nuov. Gen. Sp. Sicil. p. 96. 1810, *descr.*
*aggregatum Raf., op. cit. p. 97, *descr.* Sicily.
*hyalinum Raf., op. cit. p. 97, *descr.* Sicily.
*pisiforme Raf., l. c. p. 96, *descr.* Sicily.
*rubescens Raf., op. cit. p. 97, *t. 20. f. 11, descr.* Sicily.
*__Physotris__ Raf., Car. Nuov. Gen. Sp. Sicil. p. 97. 1810, *descr.*; Anal. Nat. Tabl. Univ. p. 208. 1815, *nom.*
*capitata Raf., Précis Découv. Somiol. p. 46. 1814, *descr.*; Jour. Bot. (Desv.) **4**: 273. 1814. *descr.* Sicily.
*glomerata Raf., Car. Nuov. Gen. Sp. Sicil. p. 97. 1810, *descr.* Sicily.
*__Physydrum__ Raf., Anal. Nat. Tabl. Univ. p. 208. 1815, *nom.* = *Physidrum* Raf.
*__Phytelis__ Raf., Car. Nuov. Gen. Sp. Sicil. p. 93. 1810, *descr.*; Anal. Nat. Tabl. Univ. p. 208. 1815, *nom.*
*atra Raf., op. cit. p. 94, *descr.* Sicily.
*granulata Raf., l. c., *descr.* Sicily.
*macrocarpa Raf., l. c., *descr.* Sicily.
*radiata Raf., op. cit. p. 93. *t. 20. f. 3, descr.* Sicily.
*sulcata Raf., op. cit. p. 94. *t. 20. f. 6, descr.* Sicily.
*tuberculata Raf., l. c. (as tubercolata), *descr.* Sicily. = *Lichiton phyteloides.* Raf., fide Rafinesque.
*__Phyxalium__ Raf., Anal. Nat. Tabl. Univ. p. 208. 1815, *nom.*
*__Plaxarthrus__ Raf., Anal. Nat. Tabl. Univ. p. 209. 1815, *nom.*
*__Porula__ Raf., Anal. Nat. Tabl. Univ. p. 208. 1815, *nom.*
*__Potarcus__ Raf., Am. Monthly Mag. Crit. Rev. **3**: 356. 1818, *descr.*; **4**: 208. 1819, *nom.*; Jour. Phys. Chim. Hist. Nat. **89**: 107. 1819, *descr.*; *iter.*, Isis von Oken 1820, **1**: Lit. Anz. p. 243. 1820.
*bicolor Raf., l. cc., *descr.* Ohio River.
*__Sclernax__ Raf., Car. Nuov. Gen. Sp. Sicil. p. 90. 1810, *descr.*; Anal. Nat. Tabl. Univ. p. 208, 1815, *nom.*
*lutescens Raf., l. c., *descr.* Sicily.
*truncata Raf., l. c., *descr.* Sicily.
*__Siphorus__ Raf., Car. Nuov. Gen. Sp. Sicil. p. 96. 1810, *descr.*; Anal. Nat. Tabl. Univ. p. 208. 1815, *nom.*
*alternus Raf., l. c., *t. 20. f. 9., descr.* Sicily.
*fasciculatus Raf., l. c., *descr.* Sicily.

***Siphytus** Raf., Car. Nuov. Gen. Sp. Sicil. p. 95. 1810, *descr.*
*filiformis Raf., op. cit. p. 96, *descr.* Sicily.
*hexodon Raf., l. c., *descr.* Sicily.
*obconicus Raf., l. c. *t. 20. f. 8.*, *descr.* Sicily.
***Spermipole** Raf., Car. Nuov. Gen. Sp. Sicil. p. 88. 1810, *descr.;* Anal. Nat. Tabl. Univ. p. 208. 1815, *nom.*
*effusa Raf., op. cit. p. 89, *descr.* Sicily.
***Stereonema** Raf., Anal. Nat. Tabl. Univ. p. 209. 1815, *nom.*
***Stypnion** Raf., Ann. Nat. Ann. Synop. p. 16. 1820, *descr.*
*fluitans Raf., l. c., *descr.* Ohio River.
Vaucheria DC.
*dichotoma Raf., Précis Découv. Somiol. p. 47. 1814, *descr.;* Jour. Bot. (Desv.) **4:** 274. 1814, *descr.* Sicily.
*flexuosa Raf., l. cc., *descr.* Sicily.
*stricta Raf., l. cc., *descr.* Sicily.
***Vermilaria** Raf., Anal. Nat. Tabl. Univ. p. 208. 1815, *nom.*
Volvox Linn.
*fuscus Raf., Specch. Sci. **2:** 68. 1814, *descr.* Sicily.
*ovalis Raf. l. c., *descr.* Sicily.
***Zonaria** Raf. Anal. Nat. Tabl. Univ. p. 208. 1815, *nom.*

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Actigea Raf., Précis Découv. Somiol. p. 52. 1814, *descr.;* Anal. Nat. Tabl. Univ. p. 211. 1815, *nom.;* Med. Fl. **2:** 222. 1830, *nom., nota* = *Scleroderma* Pers. fide Saccardo. = ? *Scleroderma* Pers. fide Fischer.
multifida Raf., Précis Découv. Somiol. p. 52. 1814, *descr.* New Jersey = *Scleroderma flavidum* Ell. & Ev. fide Saccardo.
sicula Raf., l. c., *descr.* Sicily = *Scleroderma geaster* Fries, fide Saccardo.
***Actigena** Raf., Jour. Bot. (Paris) **4:** 276 (err. 176). 1814, *descr.* = *Actigea* Raf.
*multifida Raf., l. c., *descr.* New Jersey = *Actigea multifida* Raf.
*sicula Raf., l. c., *descr.* Sicily = *Actigea sicula* Raf.
Actinophora Raf., Med. Repos. II. **3:** 423. 1806, *nom.;* op. cit. **5:** 355. 1808, *nom.;* Jour. Bot. (Paris) **2:** 176. 1809, *nom.;* Précis Découv. Somiol. p. 51. 1814, *descr.;* Jour. Bot. (Desv.) **4:** 275. 1814, *descr.;* Anal. Nat. Tab. Univ. p. 211. 1815, *nom.;* Fischer in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. **7a:** 119. 1933, *gen. dub.*
*aurantiaca Raf. l. cc., *nom.*, Précis Découv. Somiol. p. 51. 1814, *descr.;* Jour. Bot. (Desv.) **4:** 275. 1814, *descr.;* Gerard, Bull. Torr. Bot. Club **12:** 37. 1885, *nom.* Delaware, Pennsylvania.
***Actycus** Raf., Chloris Aetn. p. 13. 180, *nom.*
*siculus Raf., l. c., *nom.* Sicily.
Aecidium Pers.
*citrinum Raf., Stat. Gen. Sicil. p. 28. 1810, *nom.* Sicily.
Aedycia Raf., Med. Repos. II. **5:** 358. 1808, *descr.;* Jour. Bot. (Paris) **1:** 222. 1809, *descr.;* Anal. Nat. Tabl. Univ. p. 211. 1815, *nom.* = *Mutinus* Fries, fide Saccardo.
*alba Raf., l. cc., *descr.;* Gerard, Bull. Torr. Bot. Club **12:** 37. 1885, *nom.* Pennsylvania.
*rubra Raf., l. cc., *descr.* Pennsylvania.
Agaricus Linn.
*aterrimus Raf., Jour. Bot. (Desv.) **1:** 236. 1813, *descr.* Delaware = *Amanita aterrima* Raf.
*azureus Raf., l. c., *descr.* Delaware = *Amanita azurea* Raf.
*ellipticus Raf., Am. Monthly Mag. Crit. Rev. **3:** 356. 1818, *nom.* Alleghany Mountains or Ohio.

*miptica Raf. ex M'Murtrie, Sketch. Louisv. p. 230. 1819, *nom.* Kentucky.
*surrectus Raf., Casket **1831**: 423, *l. f.* 1831, *descr.* Pennsylvania.

***Alveolinus** Raf., Anal. Nat. Tabl. Univ. p. 211. 1815, *nom.*

Amanita Pers.
*atterima Raf., Précis Découv. Somiol. p. 49. 1814, *descr.;* Jour. Bot. **4**: 275. 1814, *nom.* Delaware = *Agaricus aterrimus* Raf.
*azurea Raf., l. cc., *descr., nom.* Delaware = *Agaricus azureus* Raf.

***Anastomaria** Raf., Ann. Nat. Ann. Synop. p. 16. 1820, *descr.*
*campanulata Raf., l. c., *descr.* New York.
*dimidiata Raf., l. c., *descr.* New York.

***Annularia** Raf., Anal. Nat. Tabl. Univ. p. 211. 1815, *nom.*

***Astrocitum** Raf., Med. Repos. II. **3**: 423. 1806, *nom.* = *Astrycum* Raf.
*dimidiatum Raf., l. c., *nom.* New York = *Astrycum dimidiatum* Raf.
*multifidum Raf., l. c., *nom.* Pennsylvania, New Jersey = *Astrycum multifidum* Raf.
*quinquefidum Raf., l. c., *nom.* Pennsylvania, New Jersey = *Astrycum quinquefidum* Raf.

Astrycum Raf., Med. Repos. II. **5**: 355. 1808, *nom.* "tribe of the licoperdoideous" fide Rafinesque = *Actigea* Raf. fide Saccardo.
*dimidiatum Raf., l. c., *nom.;* Jour. Bot. (Paris) **2**: 175. 1809, *nom.;* Gerard, Bull. Torr. Bot. Club **12**: 37. 1885, *nom.* Pennsylvania, New Jersey.
*multifidum Raf., l. cc., *nom.;* Gerard, l. c., *nom.* Pennsylvania, New Jersey.
*quinquefidum Raf., l. cc., *nom.* Pennsylvania, New Jersey.

Boletus Dill.
*hematoporus Raf. ex M'Murtrie, Sketch. Louisv. p. 230. 1819, *nom.* Kentucky.
*pusillus Raf., Chloris Aetn. p. 13. 1815, *nom.* Sicily.

Cerophora Raf., Med. Repos. II. **5**: 355. 1808, *nom.;* Jour. Bot. (Paris) **2**: 176. 1809, *nom.;* Précis Découv. Somiol. p. 49. 1814, *descr.;* Jour. Bot. (Desv.) **4**: 275. 1814, *descr.;* Anal. Nat. Tabl. Univ. p. 211. 1815, *nom.* = *Hericium* Pers. fide Saccardo.
*capitata Raf., Précis Découv. Somiol. p. 50. 1814, *descr.;* Jour. Bot. (Desv.) **4**: 275. 1814, *descr.;* Gerard, Bull. Torr. Bot. Club **12**: 37. 1885, *nom.* New Jersey.
*clavata Raf., Med. Repos. II. **5**: 355. 1806, *nom.;* Jour. Bot. (Paris) **2**: 176. 1809, *nom.;* Précis Découv. Somiol. p. 49. 1814, *descr.;* Jour. Bot. (Paris) **4**: 275. 1814, *descr.;* Gerard, Bull. Torr. Bot. Club **12**: 37. 1885, *nom.* New Jersey.
*dichotoma Raf., Med. Repos. II. **5**: 355. 1808, *nom.;* Jour. Bot. (Paris) **2**: 176. 1809, *nom.;* Gerard, Bull. Torr. Bot. Club **12**: 37. 1885, *nom.* Central Atlantic United States.
*fastigiata Raf., l. cc., *nom.* Central Atlantic United States.
*globosa Raf., l. cc., *nom.* Central Atlantic United States.
*globularis Raf. ex Gerard, Bull. Torr. Bot. Club **12**: 37. 1885, *nom.* Central Atlantic United States, prob. = *C. globosa* Raf.
*minuta Raf., l. cc., *nom.* Central Atlantic United States.
*pyriformis Raf., l. cc., *nom.;* Gerard, l. c., *nom.* Central Atlantic United States.
*ramosa Raf. ex Gerard. Bull. Torr. Bot. Club **12**: 37. 1885, *nom.* Central Atlantic United States.
*thamnoides Raf., l. cc., *nom.* Central Atlantic United States.

Clavaria Vaill.
*bicolor Raf., Med. Repos. II. **5**: 363. 1808, *descr.;* Jour. Bot. (Paris) **1**: 233. 1809, *descr.;* Gerard, Bull. Torr. Bot. Club **12**: 37. 1885, *nom.* Virginia.
*citrina Raf., op. cit. 362, 233, *descr.* Pennsylvania.
*citrinofusca Raf., l. cc., *descr.;* Gerard, l. c., *nom.* Pennsylvania.
*driophylla Raf., Jour. Bot. (Paris) **1**: 233. 1809, *descr.* = *C. dryophylla* Raf.
*dryophylla Raf., Med. Repos. II. **5**: 363. 1808, *descr.;* Gerard, l. c., *nom.* Pennsylvania.

*lepidorhiza Raf., l. cc., *descr.* Maryland.
*oxantha Raf., Précis Découv. Somiol. p. 51. 1814, *descr.;* Jour. Bot. (Desv.) **1:** 237. 1813, *descr.;* op. cit. **4:** 276 (err. 176). 1814, *nom.* Maryland.
*rubescens Raf., Précis Découv. Somiol. p. 51. 1814, *descr.;* Jour. Bot. (Desv.) **1:** 237. 1813, *descr.;* Jour. Bot. (Desv.) **4:** 276 (err. 176). 1814, *nom.* Pennsylvania.
*tricolor Raf., Med. Repos. II. **5:** 363. 1808, *descr.;* Jour. Bot. (Paris) **1:** 233. 1809, *descr.;* Gerard, Bull. Torr. Bot. Club **12:** 37. 1885, *nom.* Maryland.

Colonnaria Raf., Med. Repos. II. **3:** 423. 1806, *nom.;* op. cit. **5:** 355. 1808, *descr.;* Jour. Bot. (Paris) **2:** 176. 1809, *descr.* = *Clathrus* (Mich.) Pers., fide Saccardo; Fischer in Engler & Prantl, Nat. Pflanzenfam. ed. 2, **7a:** 84. 1933 (= *Linderia* G. H. Cunningham, 1931), genus validus fide Fischer l. c. See p. 249–250.
truncata Raf., l. cc., *nom.;* Gerard, Bull. Torr. Bot. Club **12:** 37. 1885. *nom.* Pennsylvania = *Clathrus truncatus* Bosc, fide Saccardo.
urceolata Raf., l. cc., *nom.;* Gerard, l. c., *nom.* Pennsylvania = *Clathrus columnatus* Bosc, fide Saccardo.

***Cyathela** Raf., Am. Monthly Mag. Crit. Rev. **4:** 208. 1819, *nom.*
***Cyathella** Raf., Anal. Nat. Tabl. Univ. p. 211. 1815, *nom.*
***Cynicus** Raf., Anal. Nat. Tabl. Univ. p. 211. 1815, *nom.*
***Dedalea** Raf., Anal. Nat. Tabl. Univ. p. 211. 1815, *nom.* (haud Daedalea Pers.!)
***Dicarphus** Raf., Med. Repos. II. **3:** 423. 1806, *nom.;* op. cit. II. **5:** 355. 1808, *nom. subnud.;* Jour. Bot. (Paris) **2:** 176. 1809, *nom. subnud.;* Anal. Nat. Tabl. Univ. p. 211. 1815, *nom.* = ? *Hydnum* Linn., fide Saccardo.
*rubens Raf., l. cc. *nom.;* Gerard, Bull. Torr. Bot. Club **12:** 37. 1885, *nom.* Pennsylvania.
***Dicteridium** Raf., Anal. Nat. Tabl. Univ. p. 211. 1815, *nom.*
***Druparia** Raf., Med. Repos. II. **5:** 358. 1808, *descr.;* Anal. Nat. Tabl. Univ. p. 211. 1815, *nom.* = *Drupasia* Raf.
*globosa Raf., Med. Repos. II. **5:** 358. 1808, *descr.* Pennsylvania.
*rosea Raf., l. c., *descr.* Delaware.
*violacea Raf., l. c., *descr.* Pennsylvania.
*volvacea Raf. ex Gerard, Bull. Torr. Bot. Club **12:** 37. 1885, *nom.*

Drupasia Raf., Jour. Bot. (Paris) **1:** 223. 1809, *descr.;* Fischer in Engler & Prantl, Nat. Planzenfam. ed. 2, **7a:** 119. 1933, *gen. dub.* = *Druparia* Raf.
*globosa Raf. l. c., *descr.* Pennsylvania.
*rosea Raf. l. c., *descr.* Delaware.
*violacea Raf. l. c., *descr.* Pennsylvania.

Dycticia Raf. Med. Repos. II. **5:** 355. 1808, *nom.;* Jour. Bot. (Paris) **2:** 176. 1809, *nom.* = *Clathrus* (Mich.) Pers. vel. aff. fide Saccardo; Fischer in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, **7a:** 84. 1933 = ? *Clathrus* (Mich.) Pers.
*clathroides Raf., l. cc., *nom. subnud.* Delaware.

Endacinus Raf. Précis Découv. Somiol. p. 51. 1814, *descr.;* Jour. Bot. (Desv.) **4:** 276 (err. 176). 1814, *descr.* = *Polysaccum* DC. in Desport & DeCandolle fide Saccardo = *Pisolithus* A. & S.
tinctorius Raf., l. cc., *descr.* Sicily = *Polysaccum pisocarpum* Fries, fide Saccardo = *Pisolithus tinctorius* (Pers.) Coker.

***Endaematus** Raf., Specch. Sci. **2:** 105. 1814, *descr.*
*albus Raf., l. c., *descr.* Sicily.
***Endematus** Raf., Anal. Nat. Tabl. Univ. p. 207. 1815, *nom.* = *Endaematus* Raf.

Endoconia Raf., Jour. Phys. Chim. Hist. Nat. **89:** 106. 1819, *descr.; iter.,* Isis von Oken 1820, **1:** Lit. Anz. p. 243. 1820 = Hyphymocyteae *gen. incert.* fide Saccardo.
*leucomela Raf., l. cc., *descr.* Kentucky.
*stuposa Raf., l. cc., *descr.* New York.
***Endonius** Raf., Am. Monthly Mag. Crit. Rev. **4:** 208. 1819, *nom.*

*__Epixyla__ Raf., Med. Repos. II. **3**: 423. 1806, *nom.*
*clavata Raf., l. c., *nom.* Central Atlantic United States.
*cylindrica Raf., l. c., *nom.* Central Atlantic United States.
*lineata Raf., l. c., *nom.* Central Atlantic United States.
*__Eriosperma__ Raf., Med. Repos. II. **5**: 356. 1808, *nom. subnud.*; Jour. Bot. (Paris) **2**: 177. 1809, *nom. subnud.*
*alba Raf., l. cc.. *nom.* Pennsylvania.
*fugax Raf., l. cc., *nom.* Pennsylvania.
*__Eudacnus__ Raf., Anal. Nat. Tabl. Univ. p. 211. 1815, *nom.*
*__Favaria__ Raf., Anal. Nat. Tabl. Univ. p. 211. 1815, *nom.*
__Gelatina__ Raf., Med. Repos. II. **3**: 423. 1806; op. cit. **5**: 356. 1808, *descr.*; Jour. Bot. (Paris) **2**: 177. 1809, *descr.* = *Tremella* Dill., fide Saccardo.
*alba Raf., l. cc., *nom.* Eastern United States.
*aurantiaca Raf., l. c. II. **3**: 423. 1806, *nom.* Eastern United States.
*candida Raf., l. c., *nom.* Eastern United States.
*flava Raf., l. c., *nom.* Eastern United States.
*foetidissima Raf., op. cit. II. **5**: 356. 1808, *nom.*; Jour. Bot. (Paris) **2**: 177. 1809, *nom.* Eastern United States.
*lutea Raf., l. cc., *nom.* Eastern United States.
*rubra Raf., op. cit. II. **3**: 423. 1806, *nom.*; op. cit. **5**: 356. 1808, *nom.*; Jour. Bot. (Paris) **2**: 177. 1809, *nom.* Eastern United States.
*__Gelatinaria__ Raf., Anal. Nat. Tabl. Univ. p. 211. 1815, *nom.* (non Roussel !)
*__Gemmularia__ Raf., Jour. Phys. Chim. Hist. Nat. **89**: 106. 1819, *descr.*; *iter.*, Isis von Oken 1820, **1**: Lit. Anz. p. 243. 1820; Med. Fl. **2**: 270. 1830, *nom.*; Atl. Jour. **1**: 181. 1833, *descr.* = *Tucahus* Raf. = *Rugosaria* Raf.
*albida Raf., Atl. Jour. **1**: 182. 1833, *descr.*, *nom. alt. Tucahus albidus* Raf. Pennsylvania, Ohio, Kentucky.
*leviuscula Raf., Jour. Phys. Chim. Hist. Nat. **89**: 106. 1819, *descr.*; *iter.*, Isis von Oken 1820, **1**: Lit. Anz. p. 243. 1820; Atl. Jour. **1**: 181. 1833, *descr.*, *nom. alt. Tucahus leviusculus* Raf. Virginia, Kentucky.
*rimosa Raf., Atl. Jour. **1**: 181. 1833, *descr.*, *nom. alt. Tucahus rimosus* Raf. Virginia, North Carolina.
*rugosa Raf., Jour. Phys. Chim. Hist. Nat. **89**: 106. 1819, *descr.*; *iter.*, Isis von Oken 1820, **1**: Lit. Anz. p. 243. 1820; Atl. Jour. **1**: 181. 1833, *descr.*, *nom. alt. Tucahus rugosus* Raf. Maryland, South Carolina.
*__Geoglossum__ Raf., Anal. Nat. Tabl. Univ. p. 211. 1815, *nom.* (an Persoon ?)
*__Gymnopus__ Raf., Anal. Nat. Tabl. Univ. p. 211. 1815, *nom.* (an Persoon ?)
__Hectocerus__ Raf., Med. Repos. II. **3**: 423. 1806, *nom.* = *Hericium* Pers., fide Saccardo.
*clavatus Raf., l. c., *nom.* Central Atlantic United States.
*dichotomus Raf., l. c., *nom.* Central Atlantic United States.
*globosus Raf., l. c., *nom.* Central Atlantic United States.
*pyriformis Raf., l. c., *nom.* Central Atlantic United States.
*thamnoides Raf., l. c., *nom.* Central Atlantic United States.
__Hepataria__ Raf., Med. Repos. II. **5**: 350. 1808, *nom.*; Jour. Bot. (Paris) **2**: 168. 1809, *nom.* = *Tremella* Dill. vel aff. fide Saccardo.
*cuneata Raf., l. cc., *nom.* Central Atlantic United States.
*erecta Raf., l. cc., *nom.* Central Atlantic United States.
__Hericium__ Pers.
*grande Raf., Jour. Bot. (Desv.) **1**: 236. 1813, *descr.*; Précis Découv. Somiol. p. 50. 1814, *descr.*; Jour. Bot. (Desv.) **4**: 276 (err. 176) 1814, *nom.* New Jersey.
__Hydnum__ Linn.
*aurantinum Raf.. Précis Découv. Somiol. p. 50. 1814, *descr.* Delaware = *H. aurantium* Raf.
*aurantium Raf., Jour. Bot. (Desv.) **1**: 237. 1813, *descr.*; op. cit. **4**: 276 (err. 176). 1814, *nom.* Delaware.

barbatum Raf., Med. Repos. II. **5**: 363. 1808, *descr.*; Jour. Bot. (Paris) **1**: 234. 1809, *descr.*; Gerard, Bull. Torr. Bot. Club **12**: 37. 1885, *nom.* Delaware = *Hydnum* sp. dub. fide Saccardo.

caerulescens Raf., Med. Repos. II. **5**: 363. 1808, *descr.*; Jour. Bot. (Paris) **1**: 234. 1809, *descr.*; Gerard, Bull. Torr. Bot. Club **12**: 37. 1885, *nom.* (*cerulescens*). New Jersey = *Hydnum* sp. dub. fide Saccardo (as *coerulescens*).

citrinum Raf., l. cc., *descr.*; Gerard, l. c., *nom.* Pennsylvania = *Hydnum* sp. dub. fide Saccardo.

dilatatum Raf., l. cc., *descr.*; Gerard, l. c., *nom.* Pennsylvania = *Hydnum* sp. dub. fide Saccardo.

*puniceum Raf., Jour. Bot. (Desv.) **1**: 237. 1813, *descr.*; Précis Découv. Somiol. p. 50. 1814, *descr.*; Jour. Bot. (Desv.) **4**: 276 (err. 176). 1814, *nom.* Delaware.

Hydromycus Raf., Med. Repos. II. **5**: 356. 1808, *nom. subnud.*; Jour. Bot. (Paris) **2**: 178. 1809, *nom. subnud.* = *Dacryomyces* Nees fide Saccardo.

*aquosus Raf., l. cc., *nom.* New Jersey, Pennsylvania.

*tremelloides Raf., l. cc., *nom.* New Jersey, Pennsylvania.

Hypolepia Raf., Med. Repos. II. **5**: 356. 1808, *nom. subnud.*; Jour. Bot. (Paris) **2**: 178. 1809, *nom. subnud.* = *Dacryomyces* Nees fide Saccardo.

*difformis Raf., l. cc., *nom.* Central Atlantic United States.

*igniarias Raf., Med. Repos. II. **5**: 356. 1808, *nom.* Central Atlantic United States.

*ignarius Raf., Jour. Bot. (Paris) **2**: 178. 1809, *nom.* Central Atlantic United States.

Isaria Pers.

*odora Raf., Jour. Bot. (Desv.) **1**: 237. 1813, *descr.*; Précis Découv. Somiol. p. 51. 1814, *descr.*; Jour. Bot. (Desv.) **4**: 276 (err. 176). 1814, *nom.* Maryland.

***Lamyxis** Raf., Ann. Nat. Ann. Synop. p. 16. 1820, *nom. provis.* sub *Sisostrema globularis* Raf.

Leptopora Raf., Med. Repos. II. **5**: 355. 1808, *descr.*; Jour. Bot. (Paris) **2**: 177. 1809, *descr.* = *Poria* Pers. fide Saccardo.

*difformis Raf., l. cc., *nom.* Central Atlantic United States.

*nivea Raf., l. cc., *nom.* Central Atlantic United States.

*stercoraria Raf., l. cc., *nom.* Central Atlantic United States.

Lycoperdon (Tourn.) Pers.

*coccineum Raf., Jour. Bot. (Desv.) **1**: 237. 1813, *descr.*; Précis Découv. Somiol. p. 51. 1814, *descr.*; Jour. Bot. (Desv.) **4**: 276 (err. 176). 1814. *nom.* Delaware.

*violacinum Raf., (*Lycoperdum*) Jour. Bot. (Paris) **4**: 276 (err. 176). 1814, in syn. [Pennsylvania] = *Omalycus violacinus* Raf.

Lycopodium Linn.

*violacinum Raf., Jour. Bot. (Desv.) **1**: 236. 1813, *descr.* sub *Mycastrum siculum* Raf., — *Lycoperdon* intended. Pennsylvania = *Omalycus violacinus* Raf.

Merulius Pers.

*undulatus Raf., Jour. Bot. (Desv.) **1**: 237. 1813, *descr.*, Précis Découv. Somiol. p. 50. 1814, *descr.* Maryland.

Morchella Dill.

*cava Raf., Car. Nuov. Gen. Sp. Sicil. p. 88. 1810, *descr.*; Stat. Gen. Sicil. p. 28. 1810, *nom.*; Chloris Aetn. p. 14. 1815, *nom.* Sicily.

*odorata Raf., Fl. Ludovic. p. 12. 1817, *descr.* Louisiana.

Mycastrum Raf., Jour. Bot. (Desv.) **1**: 236. 1813, *descr.* = *Omalycus* Raf. fide Desv., Jour. Bot. (Desv.) **4**: 276 (err. 176). 1814 = *Actigea* Raf. fide Saccardo.

*siculum Raf., l. c., *descr.* Sicily.

***Nidularia** Raf., Anal. Nat. Tabl. Univ. p. 211. 1815, *nom.* (an Fries ?)

Omalycus Raf., Précis Découv. Somiol. p. 52. 1814, *descr.*; Anal. Nat. Tabl. Univ. p. 211. 1815, *nom.* = *Scleroderma* Pers. fide Saccardo.

*erosus Raf., Précis Découv. Somiol. p. 52. 1814, *nom. nov.*, *Lycoperdon complanatum* Desv., Jour. Bot. (Desv.) **4**: 276 (err. 176). 1814.

violacinus Raf., l. cc., *descr.*, *nom.* (*Lycoperdon violacinum* Raf.). Pennsylvania = *Scleroderma violacinum* De Toni, fide Saccardo.

***Onygena** Raf., Anal. Nat. Tabl. Univ. p. 211. 1815, *nom.* (an Persoon ?)

Peziza Dill.

*alborufa Raf., Med., Repos. II. **5**: 362. 1808, *descr.*; Jour. Bot. (Paris) **1**: 232. 1809, *descr.*; Gerard, Bull. Torr. Bot. Club **12**: 37. 1885, *nom.* Pennsylvania.

*atrata Raf., l. cc., *descr.* Pennsylvania, New Jersey.

*cupularia Raf., Med. Repos. II. **5**: 362. 1808, *descr.* Delaware = seq.

*cupularis Raf., Jour. Bot. (Paris) **1**: 232. 1809. *descr.* Delaware.

*depressa Raf., l. cc., *descr.*; Gerard, Bull. Torr. Bot. Club **12**: 37. 1885, *nom.* Pennsylvania.

*globulosa Raf., l. cc., *descr.*; Gerard, l. c., *nom.* Pennsylvania.

*lupularia Raf. ex Gerard, Bull. Torr. Bot. Club **12**: 37. 1885, *nom.*

*ochrochlora Raf., l. cc., *descr.*; Gerard, l. c., *nom.* New Jersey.

*pulcherrima Raf., l. cc., *descr.*; Gerard, l. c., *nom.* Pennsylvania.

*smaragdina Raf., Jour. Bot. (Paris) **1**: 232. 1809, *descr.* Pennsylvania.

*smeraldina Raf., Med. Repos. II. **5**: 362. 1808, *descr.*; Gerard, Bull. Torr. Bot. Club **12**: 37. 1885 (*smiraldina*) Pennsylvania = *P. smaragdina* Raf.

***Pherima** Raf., Am. Monthly Mag. Crit. Rev. **4**: 208. 1819, *nom.* = *Phorima* Raf.

***Phiala** Raf., Anal. Nat. Tabl. Univ. p. 211. 1815, *nom.* (an *Phialea* Fries ?)

Phorima Raf., Med. Repos. II. **3**: 423. 1806, *nom.*; op. cit. **5**: 355. 1808, *descr.*; Précis Découv. Somiol. p. 49. 1814, *descr.*; Jour. Bot. (Desv.) **4**: 275. 1814, *descr.*; Anal. Nat. Tabl. Univ. p. 211. 1815, *nom.* = *Favolus* Beauv. fide Desvaux, Jour. Bot. (Desv.) **4**: 275. 1814.

*betulina Raf., Med. Repos. II. **3**: 423. 1806, *nom.*; op. cit. **5**: 355. 1808, *nom.*; Jour. Bot. (Paris) **2**: 177. 1809, *nom.*; Gerard, Bull. Torr. Bot. Club **12**: 37. 1885, *nom.* Central Atlantic United States.

*boletoides Raf., Med. Repos. II. **3**: 423. 1806, *nom.* Central Atlantic United States.

*coccinea Raf., op. cit. II. **5**: 355. 1808, *nom.*; Jour. Bot. (Paris) **2**: 177. 1809, *nom.* Central Atlantic United States.

*difformis Raf., op. cit. II. **3**: 423. 1806, *nom.* Central Atlantic United States.

*minuta Raf., op. cit. II. **5**: 355. 1808, *nom.*; Précis Découv. Somiol. p. 49. 1814, *descr.*; Jour. Bot. (Paris) **2**: 177. 1809, *nom.*; Jour. Bot. (Desv.) **4**: 275. 1814, *descr.* Central Atlantic United States.

***Phyllops** Raf., Fl. Ludovic. p. 172. 1817, *nom.* Louisiana.

***Piemycus** Raf., Jour. Bot. (Desv.) **1**: 236. 1813, *nom.* subgen. sub *Mycastrum siculum* Raf. = *Piesmycus* Raf.

Piesmycus Raf., Med. Repos. II. **5**: 355. 1808, *descr.*; Jour. Bot. (Paris) **2**: 176. 1809, *descr.* = Lycoperdon (Tourn.) Pers. vel aff. fide Saccardo; gen. dub. fide Fischer in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, **7a**: 72. 1933.

*nigrescens Raf., l. cc., *nom.* Central Atlantic United States.

*violaceus Raf., l. cc., *nom.* Central Atlantic United States.

***Polystema** Raf., Ann. Nat. Tabl. Univ. p. 211. 1815, *nom.*

***Poronea** Raf., Ann. Nat. Tabl. Univ. p. 207. 1815, *nom.*

Priapus Raf., Med. Repos. II. **3**: 423. 1806, *nom.*; op. cit. **5**: 355. 1808, *nom. subnud.*; Jour. Bot. (Paris) **2**: 176. 1809, *nom. subnud.* = *Phallus* Linn. vel aff. fide Saccardo.

*niveus Raf., l. cc., *nom. subnud.* Virginia.

***Pyrenium** Raf., Anal. Nat. Tabl. Univ. p. 211. 1815, *nom.*

Pyrisperma Raf., Med. Repos. II. **3**: 423. 1806, *nom.*; op. cit. **5**: 355. 1808; *nom. subnud.*; Jour. Bot. (Paris) **2**: 177. 1809, *nom. subnud.* = *Tuber* (Micheli) Fries vel aff. fide Saccardo.

*hypogea Raf., l. cc., *nom.* New Jersey.

***Ramaria** Raf., Anal. Nat. Tabl. Univ. p. 211. 1815, *nom.* (an Persoon ?)

Riella Raf. ex Sacc., Syll. Fung. **15:** 323. 1901, in syn. = *Rimella* Raf. = *Tylostoma* Pers. vel aff. fide Saccardo.[8]

Rimella Raf., Am. Monthly Mag. Crit. Rev. **4:** 208. 1819, *nom.;* Jour. Phys. Chim. Hist. Nat. **89:** 106. 1819, *descr.; iter.,* Isis von Oken 1820, **1:** Lit. Anz. p. 243. 1820 = *Tylostoma* Pers. vel aff. fide Saccardo.

*obovalis Raf., Jour. Phys. Chim. Hist. Nat. **89:** 106. 1819, *descr.; iter.,* Isis von Oken 1820, **1:** Lit. Anz. p. 243. 1820. Virginia and along the Ohio River.

***Rotula** Raf., Anal. Nat. Tabl. Univ. p. 211. 1815, *nom.*

***Rugosaria** Raf., Atl. Jour. **1:** 181. 1833, *nom. alt. Gemmularia* Raf. = *Tucahus* Raf.

***Sarcanthia** Raf., Fl. Ludovic. p. 172. 1817, *nom.* Louisiana.

***Sarcomelas** Raf., Fl. Ludovic. p. 172. 1817, *nom.* Louisiana.

Sarconemus Raf., Anal. Nat. Tabl. Univ. p. 210. 1815, *nom.* "genus omnino incertum" Saccardo.

***Sisostrema** Raf., Ann. Nat. Ann. Synop. p. 16. 1820, *nom.,* ut videtur sphalm. = *Sistotrema* Pers.

*globularis Raf., l. c., *descr.* New York.

***Sphaeropsis** Raf., Anal. Nat. Tabl. Univ. p. 207. 1815, *nom. nov.* = *Sphaeria* Pers.

Stemastrum Raf., Med. Repos. II. **5:** 355. 1808, *nom. subnud.;* Jour. Bot. (Paris) **2:** 177. 1809, *nom. subnud.* Virginia = *Geaster* Mich. aff. fide Saccardo.

*Boscii Raf., l. cc., *nom. subnud.* Virginia.

***Stericium** Raf., Am. Monthly Mag. Crit. Rev. **4:** 208. 1819, *nom.*

***Stipiza** Raf., Ann. Nat. Tabl. Univ. p. 211. 1815, *nom.*

Thelephora Ehrh.

*aurantiaca Raf., Med. Repos. II. **5:** 363. 1808, *descr.;* Jour. Bot. (Paris) **1:** 233. 1809, *descr.* Central Atlantic United States.

*nigrescens Raf., Jour. Bot. (Desv.) **1:** 237. 1813, *descr.;* Précis Découv. Somiol. p. 50. 1814, *descr.;* Jour. Bot. (Desv.) **4:** 276 (err. 176). 1814, *nom.* Pennsylvania.

*revoluta Raf., l. cc., *descr.;* Jour. Bot. (Desv.) **4:** 276 (err. 176). 1814, *nom.* Pennsylvania.

*semicampanulata Raf., Med. Repos. II. **5:** 363. 1808; Jour. Bot. (Paris) **1:** 233. 1809, *descr.* Pennsylvania.

***Trichidium** Raf., Anal. Nat. Tabl. Univ. p. 211. 1815, *nom. nov. Trichia* Hall.

Tuber (Micheli) Fries

*rufescens Raf., Jour. Bot. (Paris) **1:** 235. 1813, *nom.;* Précis Découv. Somiol. (p. 3 of cover), *nom.* Sicily.

***Tuberium** Raf., Anal. Nat. Tabl. Univ. p. 211. 1815, *nom. nov. Tuber* (Micheli) Pers.

***Tucahus** Raf., Med. Fl. **2:** 270. 1830, *descr.;* Atl. Jour. **1:** 1833, *descr.* = *Gemmularia* Raf. = *Rugosaria* Raf. fide Raf.

*albidus Raf., l. cc., *nom., descr.* Pennsylvania, Ohio, Kentucky.

*leviusculus Raf., l. cc., *nom., descr.* Carolina.

*rimosus Raf., Atl. Jour. **1:** 181. 1833, *descr.* Virginia and North Carolina.

*rugosus Raf., l. cc., *nom., descr.* Maryland to South Carolina.

Uredo Pers.

*citrina Raf., Car. Nuov. Gen. Sp. Sicil. p. 88. 1810, *descr.* Sicily, on *Dianthus dubius.*

Volvaria Fries

*coccinea Raf., Med. Repos. II. **3:** 423. 1806, *nom.;* Gerard, Bull. Torr. Bot. Club **12:** 37. 1885, *nom.* Maryland = *Volvycium coccineum* Raf.

Volvycium Raf., Med. Repos. II. **5:** 358. 1808, *descr.;* Jour. Bot. (Paris) **1:** 222. 1809, *descr.;* Anal. Nat. Tabl. Univ. 211. 1815, *nom.* = *Battarrea* Pers. aff. fide

[8] In all of Rafinesque's published papers that I have examined I did not detect the name *Riella* Raf. It is perhaps published in the work of some other mycologist; unfortunately Saccardo cites no reference.

Saccardo = gen. dub. fide Fischer in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, **7a**: 119. 1933.

*coccineum Raf., l. cc., *descr.;* Gerard, Bull. Torr. Bot. Club **12**: 37. 1885, *nom.* Maryland.

Xylissus Raf., Med. Repos. II. **5**: 356. 1808, *nom. subnud.;* Jour. Bot. (Paris) **2**: 177. 1809, *nom. subnud.* = *Dacryomyces* Nees vel aff. fide Saccardo.

*cylindricus Raf., l. cc., *nom.* Pennsylvania.

*lineatus Raf., l. cc., *nom.* Pennsylvania.

*oblongus Raf., l. cc., *nom.* Pennsylvania.

***Zonilia** Raf., Anal. Nat. Tabl. Univ. p. 211. 1815, *nom.*

LICHENES

***Epidrolithus** Raf., Life of Travels p. 136. 1836, *nom.* Pennsylvania. An *Leptogium* (Ach.) S. Gray ?

***Leptuberia** Raf., Med. Repos. II. **5**: 350. 1808, *nom.;* Jour. Bot. (Paris) **2**: 167. 1809, *nom.*

*amorpha Raf., l. cc., *nom.* Pennsylvania.

***Scyphorus** Raf., Anal. Nat. Tabl. Univ. p. 208. 1815, *nom. nov. Scyphophorus* Acharius.

MUSCI

***Diphas** Raf., Am. Monthly Mag. Crit. Rev. **1**: 429. 1817, *nom. nov. Diphascum* Eaton = *Diphyscium* Ehr.

***Heterodon** Raf., Med. Repos. II. **5**: 350. 1808, *nom.;* Jour. Bot. (Paris) **2**: 167. 1809, *nom.* = ? *Fissidens* Hedwig.

*bryoides Raf., l. cc., *descr.* New Jersey.

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NOTES ON THE SYNONYMY OF SOME NORTH AMERICAN THELEPHORACEAE AND OTHER RESUPINATES [1]

D. P. Rogers and H. S. Jackson

In the pages which follow it is proposed to record changes which appear to be necessary in the nomenclature of species in certain genera of North American resupinate basidiomycetes, mainly in the Thelephoraceae, which have come to our attention during the past eight or ten years. Through correspondence and personal conference the authors recently came to realize that they were independently covering much the same ground and obtaining comparable results. It was, therefore, decided to pool such of their findings to date as have to do with nomenclatorial changes. This joint paper is the result.

The cosmopolitan distribution of many species, particularly in the north temperate regions, has perhaps not been fully appreciated. Many American species assumed to be endemic are found to be the same as well known European species. The thelephoraceous flora of northeastern and northwestern North America, for example, is surprisingly like that of Sweden, Finland, and the mountainous region of central Europe; and the mycobiota of central North America shows corresponding similarities to that of the more western and southern parts of Europe. This situation has made necessary a considerable number of changes in names now current in America. Anyone who describes North American species as new and has not an extensive knowledge of the European forms is taking a grave risk of merely adding to the synonymy. Then, too, methods of study which place disproportionate emphasis on the characters brought out by the examination of cross sections, and which obscure or disregard the more fundamental characters of basidia and spores and the more detailed morphology of the hyphae, have often resulted in unnecessary duplication of names. An object of this study has been to discover identities between European and American species, and between species described from incomplete observations; by such reduction in the number of current names the taxonomic confusion within the groups in question is reduced, and the amount of information available concerning any one form is increased.

Furthermore, any student who has devoted considered attention to taxonomic study of the resupinate genera of Thelephoraceae is soon forced to the realization that all too little regard has been given by former students of the group to the exact application of nomenclatorial rules. Many of the names in common use in Europe and in America are clearly synonyms or are obviously untenable for one reason or another. A good deal of current usage is contrary not only to the Rules but to non-legal reason.

[1] Joint contribution from the Laboratories of Cryptogamic Botany and the Farlow Herbarium, Harvard University, No. 201, and the Department of Botany, University of Toronto.

In several cases the same specific name, with the same type, is found serving as the basis for binomials in two different genera. Even more commonly a binomial is ascribed to a mycologist who had no intention of publishing a new taxonomic entity, but who was merely transferring, or redescribing, an older species; frequently the later worker is said to have established a type, even though he clearly cited the name and description of the earlier. A second object of this study has been to determine, so far as is possible, the correct name for the species treated; it is hoped that these two objects, the taxonomic and the nomenclatorial, may contribute to a more stable ultimate nomenclature.

To the close student of the group it is also evident that there is great need for generic revision. At present it is obvious that in many instances closely related species are classified in different genera. Real relationships are often found to cut across family lines. Revision in this group should, however, proceed slowly and progressively. No person as yet possesses the wide and accurate knowledge of species which would be necessary before any sweeping revision could be proposed. It is clear, however, that certain groups of species, part of which may now be included in one genus and part in another, show obvious relationship based on characters believed to be of fundamental importance. As such groups come to be well understood they should be segregated.

It is not the purpose of the present paper to attempt any revision. Certain segregates, largely from *Corticium*, which have already been proposed, are here accepted and certain transfers not previously made are provided. The segregates which are accepted include *Ceratobasidium* Rogers, *Pellicularia* Cooke (= *Botryobasidium* Donk), *Vararia* Karsten (= *Asterostromella* Höhn. & Litsch.), and *Trechispora* Karsten (= *Sistotrema sensu* Donk and Rogers p.p.). These genera, we feel, represent natural groups of species.

The genus *Gloeocystidium*, commonly in use by many European students, does not, as at present delimited, necessarily bring together related species. We prefer to leave such species in *Corticium* for the present, as Burt has done. However, since there is no sharp distinction between gloeocystidia and cystidia, a number of species included by some authors in *Gloeocystidium* but by others in *Peniophora*, e.g., *P. tenuis* (Pat.) Massee, will here be found in the latter genus rather than in *Corticium*, when their relationship seems to be with better characterized *Peniophora* species. Similarly, several American species which have been described in *Peniophora*, having projecting gloeocystidia but showing no marked affinity to that genus (e.g., *P. albo-straminea* Bres.), have been transferred to *Corticium*. While such procedure is recognized as merely a temporary expedient, it serves to bring all definitely gloeocystidiate but non-cystidiate forms together in one genus, with the recognition that that genus, like some others at present, is merely a convenient repository.

Tomentella, as has already been pointed out by Rogers, must replace

Hypochnus sensu Burt. No attempt is made at this time to include transfers for the American species which properly belong there. To do this arbitrarily without a thorough revision of the genus as a whole would only add unnecessary names to the ultimate synonymy. Since, however, certain rough-spored species included in *Hypochnus* by Burt and others are not Tomentellas, these are provided for in other genera.

The present work includes *Sebacina* of the Tremellaceae, *Tulasnella* and *Gloeotulasnella* of the Tulasnellaceae, and in the Thelephoraceae the older genera *Aleurodiscus, Asterostroma, Coniophora, Hypochnus, Corticium* (in the broadest sense), and *Peniophora.* No attempt has yet been made to examine the other genera critically and no claim is made to completeness or finality in the genera mentioned. In *Corticium* and *Peniophora,* for example, many of the southern and subtropical species have not been reviewed and in the latter genus the section *Coloratae* has not been considered. We are including only such changes as have for one reason or another come to our attention and concerning which we are in general agreement. Further study of some of the species included may reveal that we have erred on the side of ultraconservatism and it may later be found desirable, when more abundant material is available for study, to restore to specific rank certain species which are here treated as synonyms. The present conservative treatment in such cases, however, has the advantage of emphasizing obviously close relationship.

The series of papers on North American Thelephoraceae prepared by the late Dr. E. A. Burt constitutes the only monographic treatment of the North American species of the Thelephoraceae available. Since Burt's treatise enumerates or (with a few exceptions) accounts for all the North American names recorded previous to the dates of publication of the several parts, this pioneer work is taken as the basis of the present contribution. In the series of items making up the body of this paper the first name in each paragraph heading is the name to be found in Burt if he dealt with the species at all, and in most cases is followed by a second, accepted name, separated by an = sign. In its proper place the accepted name is printed in bold-face type.

To the corrections to names used by Burt have been added: (a) corrections to names, new or old, which have been recorded for North America since the publication of Burt's account; (b) a few corrections involving older American names which were not accounted for by Burt. Additions to the North American flora are not included except as they may be incidentally mentioned in connection with corrections to Burt's identification of paratypes or other cited collections. Similarly, additions to the synonymy of American species are listed only if the species is included for other reasons.

Burt included, in his monographic treatment of the Thelephoraceae, the genus *Sebacina* of the Tremellaceae (along with other resupinate genera) and *Tulasnella* of the Tulasnellaceae. These genera have since been

re-monographed for North America — *Sebacina* by McGuire and *Tulasnella* by Rogers. In the present work, names in *Sebacina* have been treated only where it has been possible to add to the results reported by McGuire; for most of the species included in Burt the reader is referred to McGuire's recent monograph in Lloydia **4**: 1–43. 1941; *Tulasnella* is treated in the same way as outlined for the Thelephoraceae. Changes in names used by Burt or changes found necessary for names used in other later discussions are here brought together even though this involves some repetition of information already available.

The arrangement is alphabetical by genera and species without reference to the families listed.

Authorities for species have been cited more fully than is customary or ordinarily necessary. This is done in order that the citation may fulfill its chief function, which is to set forth the history and especially the typification of the species. To take an example from the synonymy listed under *Coniophora atrocinerea* (p. 273): to write "*Thelephora olivacea* Pers.," as is allowable under the Rules (Art. 46, 48, Rec. XXXII), would conceal the fact that the species was originally described by Fries and should be interpreted after consultation of his treatment. To write: "*T. olivacea* Fries ex Pers.," as is probably also allowable, would imply that Fries had described the species under *Thelephora olivacea,* whereas in fact it was Persoon who first ascribed it to that genus. The form "*T. olivacea* [Fries] ex Pers." indicates: 1) that the species is a "pre-Friesian" one, first validly published by Persoon, and 2) that Fries described it in another genus. The forms "*Coniophora olivacea* Karst.," "*C. olivacea* (Pers.) Karst.," and "*C. olivacea* ([Fries] ex Pers.) Karst." are the three allowable forms of citation for the species when it is transferred to *Coniophora;* the most complete is the one used throughout the present paper, although a shorter one would serve where it was desired to refer to the fungus without entering upon a consideration of its history. "*Coniophora olivacea* Fries" is a false citation: Fries never assigned the species to the genus *Coniophora;* and "*C. olivacea* (Fries) Karst." is equally incorrect, since not Fries, but Persoon, first published the species, in the sense of the Rules.

In their indispensible book "Hyménomycètes de France" Bourdot & Galzin often used binomials for groups of fungi of subspecific rank. This practise, not allowable under Art. 12 and Art. 28 of the Rules, has frequently led to misunderstanding of the authors' intent: later workers have used as names of species binomials which Bourdot & Galzin published for subspecies only. In the "Hyménomycètes de France" the authors (p. iv) gave the explanation of their practise: the rank of a group is indicated by typography, and instead of writing "subsp." they printed the name in slanted type. Thus, for example, *Peniophora media, P. lurida,* and *P. attenuata,* published on p. 294, are not species, but subspecies of *P. subalutacea.* In the series of papers in the Bulletin of the Société

Mycologique de France which constitute their first general treatment of the "Hyménomycètes de France" the same typographical system is used; there, however, the rank of subspecies, varieties, and forms is usually indicated also by the customary abbreviations. The precise concept or definition of a subspecies held by Bourdot & Galzin need not be considered in evaluating the nomenclatorial status of their names, since it is clear that the illegitimate binomials in question are intended for groups of rank inferior to the species. In the present paper, therefore, such names are written out in full so as to retain the rank assigned to them by these authors — as, for example (on p. 274), "*Coniophora arida* subsp. *fumosa* (Karst.) Bourd. & Galz."

In the lists of synonyms which follow, the sign (!!) following the reference indicates that the type has been examined, while the sign (!) means that an authentic specimen has been seen. Brackets ([ ]) around dates are used where a presumably correct date has been substituted for that carried by the title page of the work in question, and elsewhere, when emphasis is considered desirable.

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It seems fitting also to acknowledge our indebtedness to the late Abbé Bourdot for having provided, in Bourdot and Galzin's "Hyménomycètes de France," the most useful summary of the species of lower basidiomycetes that has yet appeared.

ALEURODISCUS

ALEURODISCUS APICULATUS Burt = **A. mirabilis** (Berk. & Curt.) Höhn.

Psilopezia mirabilis Berk. & Curt., Linn. Soc. Bot. Jour. **10:** 364. [1868] (!!); Massee, Jour. Mycol. **6:** 179. 1891.

Corticium peradeniae Berk. & Br., Linn. Soc. Bot. Jour. **14:** 69. 1873.

Aleurodiscus javanicus P. Henn., Monsunia **1:** 139. 1900 (!!).

Aleurodiscus peradeniae (Berk. & Br.) P. Henn., Monsunia **1:** 139. 1900; Burt, Missouri Bot. Gard. Ann. **10:** 187. 1923.

Corticium javanicum (P. Henn.) Sacc. & Syd., Syll. Fung. **16:** 189. 1902; nec *C. javanicum* Zimm., Centralbl. Bakt. Parasit. 2 Abt. **7:** 102. 1901.

Aleurodiscus usambarensis P. Henn., Bot. Jahrb. **34:** 43. 1904 (!!).

Aleurodiscus spinulosus P. Henn., Bot. Jahrb. **38:** 107. 1905 (!!).

Corticium usambarense (P. Henn.) Sacc. & Sacc., Syll. Fung. **17**: 168. 1905.
Aleurodiscus mirabilis (Berk. & Curt.) Höhn., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **118,** I: 818. 1909.
Corticium spinulosum (P. Henn.) Sacc. & Trott., Syll. Fung. **21**: 403. 1912.
Aleurodiscus apiculatus Burt, Missouri Bot. Gard. Ann. **5**: 186. fig. 4. 1918 (!!).
Aleurodiscus albo-roseus Bres., Ann. Mycol. **18**: 46. 1920 (!!).
Aleurodiscus Peteloti Pat., Soc. Mycol. Fr. Bul. **40**: 31. 1924 (!!).
Aleurodiscus salmoneus Pat., Acad. Malgache Mem. **6**: 11. pl. 1. 1927.
Aleurodiscus sinensis Teng & Ling, Contr. Biol. Lab. Sci. Soc. China **8**: 273. fig. 19. 1933.
Aleurodiscus pallide-roseus Litsch., Symb. Sinica II Theil, p. 41. fig. 1. 1937.

It is highly probable that the synonymy here given is not yet complete. Burt's figures are excellent, and a sufficient basis for identification. The sublunate, biapiculate spores do not occur in any other species of *Aleurodiscus* examined. The abundant, thick-walled, long-appendiculate acanthophyses are equally characteristic. Massee assigns *P. mirabilis* to *Aleurodiscus Oakesii* (Berk. & Curt.) Cooke, from which, however, the type differs in being attached for nearly its entire area and in the possession of densely spinulose acanthophyses and in the absence of pseudophyses.

ALEURODISCUS CRASSUS Lloyd = **A. candidus** (Schw.) Burt

Thelephora candida Schw., Nat. Ges. Leipzig Schrift. **1**: 110. 1822 (!!); Fries, Elenchus Fung. **1**: 189. 1828; nec *T. candida* (Schw.) Fries, Syst. Orb. Veg. p. 82. 1825; Schw., Am. Phil. Soc. Trans. n. s. **4**: 166. [1832]. (= *Merisma candidum* Schw., Nat. Ges. Leipzig Schrift. **1**: 110. 1822; *Tremellodendron candidum* (Schw.) Atk., Jour. Mycol. **8**: 106. 1902.)
Thelephora candidissima Schw., Am. Phil. Soc. Trans. n. s. **4**: 167. [1832].
Stereum candidum (Schw.) Fries, Epicr. Syst. Mycol. p. 552. 1838.
Aleurodiscus candidus (Schw.) Burt, Missouri Bot. Gard. Ann. **5**: 188. 1918.
Aleurodiscus crassus Lloyd, Mycol. Writ. **6**: 928. 1920 (!!).

Based on a single collection made in Oregon by H. C. Gilbert, *A. crassus* is best interpreted as an unusually thick, broadly spreading condition of the common *A. candidus*. The substratum is not stated but appears to be the thick bark of some deciduous tree — probably *Quercus Garryana*, the common substratum for the species in western Oregon. The type collection agrees well with other western collections assigned to this species.

ALEURODISCUS CREMEUS Burt = **A. Bertii** Lloyd

Aleurodiscus cremeus Burt, Missouri Bot. Gard. Ann. **5**: 199. 1918 (!!); nec *A. cremeus* Pat., Soc. Mycol. Fr. Bul. **31**: 73. 1915 (!!) (= *Stereum lepra* Berk. & Br., Linn. Soc. Bot. Jour. **14**: 67. 1873 (!!); *A. lepra* (Berk. & Br..) Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **117,** I: 1098. 1908).
Aleurodiscus Bertii Lloyd, Mycol. Writ. **7**: 1288. 1924.
Aleurodiscus Burti Trott. in Sacc., Syll. Fung. **23**: 525. 1925.

Because of the existence of the earlier homonym (cf. also Lloyd, l.c.), Lloyd's name must replace Burt's. Unless an earlier description in another genus exists, the species is probably autonomous. It is characterized by hard, compact structure, by gloeocystidia showing yellow, granular

content (in 1941), and acanthophyses whose outer portions show no lumen whatever.

ALEURODISCUS GRANTII Lloyd = **A. amorphus** (Pers.) Rabenh. ex Cooke

Peziza amorpha Pers., Mycol. Eur. **1**: 269. 1822.

Thelephora amorpha (Pers.) Fries, Elenchus Fung. **1**: 183. 1828.

Corticium amorphum (Pers.) Fries, Epicr. Syst. Mycol. p. 559. 1838; Sacc., Syll. Fung. **6**: 606. 1888.

Nodularia balsamicola Peck, New York State Mus. Rept. **24**: 96. pl. 4, fig. 23–26. 1872.

Cyphella amorpha (Pers.) Quél., Ench. Fung. p. 215. 1886.

Aleurodiscus amorphus (Pers.) Rabenh. ex Cooke, Grevillea **3**: 137. 1875; Schroet. in Cohn, Krypt.-Fl. Schles. **3**(1): 429. 1888; Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **116**, 1: 799. 1907; Burt, Missouri Bot. Gard. Ann. **5**: 180. 1918; Pilát, Ann. Mycol. **24**: 211. 1926; Bourd. & Galz., Hymén. de France p. 331. [1928].

Aleurodiscus Grantii Lloyd, Mycol. Writ. **6**: 927. 1920 (!!).

(*Aleurodiscus amorphus* (Pers.) Rabenh., Fungi Eur. Exs. *1824*. 1874 (nomen nudum); Hedwigia **13**: 184. 1874 (nomen nudum).

A. Grantii was based on two collections from Washington and one from British Columbia. These have all been examined. The species was admittedly distinguished from *A. amorphus* on gross characters. Lloyd writes: "Microscopic characters as in *A. amorphus*." The differences noted do not seem sufficient to justify specific segregation from a species which, when a large series of collections is compared, shows considerable variation in the form and margin of the fruiting bodies.

The genus *Nodularia* was unmistakably described and figured by Peck in 1872. The name *Aleurodiscus* was first used, by Rabenhorst, in 1874; but neither on the label of his exsiccatum nor in the summary of the same in Hedwigia is there a word of description. The genus was therefore not published by him. Cooke's rambling discussion includes nothing that can be considered a generic diagnosis. In it he pointed out the identity of the validly published *Nodularia* and the undescribed *Aleurodiscus* — and saw fit to retain the unpublished name. This choice, unwarranted as it was by any information in his possession, and unjust as it was, constitutes publication of the name *Aleurodiscus* under Art. 42 (2) of the Rules, as has been pointed out by Donk (Bot. Gard. Buitenzorg Bul. III **17**: 160. 1941.). Since there is a *Nodularia* Link, Schrad. Neu. Jour. Bot. **4**: 9. 1809; Lyngbye, Tent. Hydrophytol. Dan. p. 99. 1819 (and a *Nodularia* Mertens apud Juerg. Alg. Aquat. dec. XV, no. 4. 1822, which, being a member of the Nostocaceae, was not nomenclatorially existent in 1872), Cooke's wrong choice proves to be the correct one to follow. It is curious that the various monographers who, aware of the identity of *Nodularia* Peck and *Aleurodiscus*, employed the later name, never felt bound to give any reasons for doing so.

ALEURODISCUS HELVEOLUS Bres. Excluded.

This species, originally described by Bresadola (Mycologia **17**: 71. 1925 (!!); Burt, Missouri Bot. Gard. Ann. **13**: 306. 1926) from a single

collection made by J. R. Weir on *Salix lasiandra* at Spokane, Washington, November 20, 1920 (Weir *16312*), may be stricken from the list of American species of *Aleurodiscus* on the grounds that its real relationship is with the fungus which, in North America, is commonly referred to *Clavaria contorta* Holmsk. ex Fries. This fungus is common on *Salix* in the Temagami Lake region, Ontario, and specimens are in the herbarium of the University of Toronto which bear some fruiting bodies which agree very well with the type of Bresadola's species, the fructifications of which are more tuberculate and less well developed than in most collections. The basidia and spores as well as other microscopic characters seem identical. Coker (The Clavarias of the United States and Canada p. 87. 1923.) places *C. contorta* as a doubtful synonym of *C. fistulosa* Holmsk. ex Fries.

ALEURODISCUS SUCCINEUS Bres. = **A. diffissus** (Sacc.) Burt

Peniophora diffissa Sacc., R. Soc. Bot. Belg. Bul. **28:** 79. pl. 4, fig. 2. 1889; Syll. Fung. **9:** 239. 1891.

Aleurodiscus succineus Bres., Mycologia **17:** 71. 1925 (!!); Burt, Missouri Bot. Gard. Ann. **13:** 309. 1926.

Aleurodiscus diffissus (Sacc.) Burt, Missouri Bot. Gard. Ann. **18:** 485. 1931; Pilát, Soc. Mycol. Fr. Bul. **49:** 328. 1933.

Aleurodiscus sajanensis (Murashk. in litt.) Pilát, Hedwigia **71:** 328. fig. 1–3. 1931 (!!).

A study of the literature listed above shows that only three collections are involved. Two of them were made in Siberia on *Rhododendron dahuricum* and the third, on which *A. succineus* was based, is reported as on *Arbutus Menziesii* from Oregon. In the latter the fructifications are evidently younger than those in Murashkinsky's collection on which Burt's transfer and Pilát's species were based. There is no question, however, that the two are identical. The species is readily distinguished by the abundant narrow acanthophyses which become yellowish with age, the presence of gloeocystidia and the sub-allantoid spores. Burt (1926) describes the spores of *A. succineus* as ellipsoid 10 x 5 μ and (1931) those of the Siberian collection as globoid 5.5–6 μ (!). They are more nearly as described by Pilát (1931) 10–15 x 4–5.5 μ, though spores as large as 18 x 7 μ are present in the Murashkinsky collection examined.

ALEURODISCUS ZELLERI Burt = **Peniophora aurantiaca** (Bres.) Höhn. & Litsch.

Corticium aurantiacum Bres., Fungi Trident. **2:** 37. 1892 (!!).

Kneiffia aurantiaca (Bres.) Bres., Ann. Mycol. **1:** 104. 1903.

Peniophora aurantiaca (Bres.) Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **115,** I: 1586. 1906; Burt, Missouri Bot. Gard. Ann. **12:** 310. [1926]; Bourd. & Galz., Hymén. de France p. 320. [1928].

Peniophora lepida Bres., Mycologia **17:** 70. 1925 (!!); Burt, Missouri Bot. Gard. Ann. **12:** 295. [1926].

Peniophora Sheari Burt, Missouri Bot. Gard. Ann. **12:** 268. [1926] (!!).

Aleurodiscus Zelleri Burt, Missouri Bot. Gard. Ann. **13:** 309. 1926 (!!).

A. Zelleri was based on a tuberculate or at most only narrowly effused form of *P. aurantiaca* not infrequent in the northwest. The type of *P.*

lepida is reported as growing on *Salix;* actually, the wood is *Alnus.* It is best interpreted as an unusually vigorous development of *P. aurantiaca* with all the essential structures, but lighter colored than usual, and sterile. *P. Sheari* is, like *P. lepida,* a thick fructification with very numerous heavily incrusted cystidia; its spores are more nearly oblong, or cylindrical, than in typical specimens of *P. aurantiaca,* but are related by intergrades with the more usual ellipsoid form.

ASTEROSTROMA

ASTEROSTROMA BICOLOR Ellis & Everh. = **A. andinum** Pat.

Asterostroma andinum Pat., Soc. Mycol. Fr. Bul. **9**: 133. 1893 (!!).
Asterostroma bicolor Ellis & Everh., Acad. Nat. Sc. Phila. Proc. **1893**: 441. 1894 (!!); Burt, Missouri Bot. Gard. Ann. **11**: 32. 1924.
Asterostroma spiniferum Burt, Missouri Bot. Gard. Ann. **11**: 33. 1924 (!!).
Asterostroma gracile Burt, Missouri Bot. Gard. Ann. **11**: 34. 1924 (!!).

The type of *A. gracile* shows a very delicate loose-arachnoid hymenium; in the types of *A. andinum* and *A. spiniferum* the hymenium is continuous, but branches of the stellate bodies emerge, appearing like the setae of a *Hymenochaete.* In none of these are the asterophyses different from those of *A. bicolor;* in all they are long-stalked, long-rayed (up to at least 125 μ in *A. andinum* and *A. spiniferum,* at least 150 μ in *A. bicolor*) and relatively slender-rayed, often somewhat asymmetrical, commonly with forking or uneven branching. In the preparations examined, subulate, cystidioid bodies were observed in the types of *A. bicolor, A. andinum,* and *A. gracile,* but not in *A. spiniferum,* where Burt reports them; probably further search would have demonstrated them there also. There are no differences other than those here noted; presumably *A. bicolor* is the name given to well developed specimens, the other names referring to younger fructifications.

ASTEROSTROMA GRACILE Burt = **A. andinum** Pat.

See under *A. bicolor.*

ASTEROSTROMA OCHROSTROMA Burt = **Asterodon ferruginosus** Pat.

Asterodon ferruginosus Pat., Soc. Mycol. Fr. Bul. **10**: 130. 1894 (!!) (ut 'ferruginosum'); Bourd. & Galz., Hymén. de France p. 398. [1928].
Hydnochaete setigera Peck, New York State Mus. Rept. **50**: 113. 1897 (!).
Asterostroma ochrostroma Burt, Missouri Bot. Gard. Ann. **11**: 34. 1924 (!!).

Asterostroma ochrostroma was described from a sterile, immature fructification of *Asterodon ferruginosus.* There is considerable doubt whether *Asterodon* ought to be maintained as a separate genus; but the matter lies outside the scope of this paper. For the gender of names in *-odon* see Art. 72(2) or any Greek lexicon.

Laurila (Soc. Zool.-Bot. Fenn. Vanamo Ann. Bot. **10** (4): 15. 1939.) gives "*Aciella tomentosa* (Schrad.) Karst." as a synonym of *A. ferruginosus.* His citation is obscure, but probably refers to *Acia* (*Aciella*) *tomen-*

tosa (Schrad.) Karst. (Bidr. Känned. Finl. Nat. Folk **48:** 362. 1889.), a name by which Karsten replaced the earlier *Acia ferruginea* (Pers.) Karst. Deferring consideration of a remarkable collection of nomenclatorial complexities, one may well suspend judgment concerning the propriety of superseding Patouillard's specific epithet until it appears at least probable that Schrader's *Hydnum tomentosum* referred to the present fungus rather than to a *Caldesiella*. As for *Hydnum ferrugineum* Pers., Fries very generously disposed of that name by reducing it to synonymy under a newly erected *H. ferruginosum* Fries, and by describing a stipitate *H. ferrugineum* Fries by which Persoon's name is now preoccupied.

ASTEROSTROMA SPINIFERUM Burt = **A. andinum** Pat.

See under *Asterostroma bicolor* Ellis & Everh.

BOTRYOBASIDIUM

BOTRYOBASIDIUM Donk = **Pellicularia** M. C. Cooke

The American species of *Botryobasidium* were first brought together by Rogers (Univ. Iowa Studies Nat. Hist. **17:** 10–19. 1935.). In a more recent paper (Farlowia **1:** 95–118. 1943.) the species of this group have again been reviewed; since the generic name *Pellicularia* Cooke antedates *Botryobasidium* Donk they have of necessity been treated under *Pellicularia*. For the sake of completeness and to conform to the stated scope of the present contribution (p. 264), the new names are listed below. References to other names which have been used in American literature will be found in their proper alphabetical position in the following pages.

Botryobasidium coronatum (Schroet.) Donk = **Pellicularia pruinata** (Bres.) Rogers.
Botryobasidium flavescens (Bon.) Rogers = **Pellicularia flavescens** (Bon.) Rogers.
Botryobasidium isabellinum (Fries) Rogers = **Pellicularia isabellina** (Fries) Rogers.
Botryobasidium ochraceum (Massee) Donk = **Pellicularia flavescens** (Bon.) Rogers.
Botryobasidium Solani (Prill. & Del.) Donk = **Pellicularia filamentosa** (Pat.) Rogers.
Botryobasidium subcoronatum (Höhn. & Litsch.) Donk = **Pellicularia subcoronata** (Höhn. & Litsch.) Rogers.
Botryobasidium vagum (Berk. & Curt.) Rogers = **Pellicularia vaga** (Berk. & Curt.) Rogers.

CERATOBASIDIUM

CERATOBASIDIUM PLUMBEUM Martin = **C. atratum** (Bres.) Rogers

Corticium atratum Bres., Hedwigia **35:** 290. 1896 (!); Rick, Brotéria Sér. Trim. Ciênc. Nat. **3:** 154. 1934.
Tulasnella metallica Rick, Brotéria Sér. Trim. Ciênc. Nat. **3:** 169. 1934 (!), saltem pro parte.
Ceratobasidium plumbeum Martin, Mycologia **31:** 513. fig. 21–27. 1939 (!!).
Ceratobasidium atratum (Bres.) Rogers ex Martin, Lloydia **4:** 262. 1941.

It would be difficult to imagine a resupinate species more distinctive than the present one, or more complete neglect of its characteristics than that exhibited in the description of *C. atratum*. It is not a "species valde

Corticio caeruleo affinis" (Bres.), nor does it show any similarity whatever to that fungus. It is well and fully described and figured by Martin as *Ceratobasidium plumbeum.*

The species has a wide distribution in the western hemisphere, as noted by Martin (1941). It appears to be quite common in northeastern North America, seven collections having been made in Ontario. Collections from Quebec and California have recently been recognized as this species.

Authentic material of *T. metallica* Rick includes both the present species and *Peniophora rimicola* (Karst.) Höhn. & Litsch.; from Rick's description it seems probable that originally he had in hand the *Ceratobasidium* rather than the *Peniophora.*

CONIOPHORA

CONIOPHORA ATROCINEREA Karst. = **C. olivacea** ([Fries] ex Pers.) Karst.

Thelephora olivacea [Fries] ex Pers., Mycol. Eur. **1**: 143. 1822 (ante diem 1 Jul.); Fries, Elenchus Fung. **1**: 197. 1828.

Thelephora Sistotremoides Schw., Nat. Ges. Leipzig Schrift. **1**: 109. 1822 (fortasse post diem 18 Jul.) (!!); Fries, Elenchus Fung. **1**: 198. 1828.

Thelephora umbrina Fries, Elenchus Fung. **1**: 199. 1828; nec *T. umbrina* Pers., Syn. Fung. p. 578. 1801.

Odontia Sistotremoides (Schw.) Fries, Epicr. Syst. Mycol. p. 529. 1838.

Hypochnus olivaceus ([Fries] ex Pers.) Fries, Summa Veg. Scand. p. 337. 1849; Karst., Bidr. Känned. Finl. Nat. Folk **25**: 320. 1876; et conf. Bres., I. R. Accad. Agiati Atti III **3**: 116. 1897; Rogers, Mycologia **31**: 299. 1939.

Hypochnus umbrinus (Fries) Fries, Summa Veg. Scand. p. 337. 1849; Quél., Fl. Mycol. p. 2. 1888, quantum ad typum; Burt, Missouri Bot. Gard. Ann. **3**: 213. 1916, **13**: 323. 1926, quantum ad typum, specim. descr. synon. excl.; Wakef., Br. Mycol. Soc. Trans. **6**: 132. 1919, tantundem; nec *H. umbrinus* (Pers.) Wallr., Fl. Crypt. Germ. **2**: 312. 1833 (= *Himantia umbrina* Pers., Syn. Fung. p. 704. 1801; Alb. & Schw., Consp. Fung. p. 373. 1805; Pers., Mycol. Eur. **1**: 89. 1822.).

Corticium brunneolum Berk. & Curt., Grevillea **2**: 4. 1873 (!!).

Corticium leucothrix Berk. & Curt., Grevillea **2**: 4. 1873 (!!).

Corticium olivaceum ([Fries] ex Pers.) Fries, Hymen. Eur. p. 660. 1874.

Hymenochaete Ellisii Berk. & Cooke, Grevillea **4**: 162. 1876; Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **116**, I: 782. 1907.

Corticium Ellisii (Berk. & Cooke) Cooke, Grevillea **8**: 89. 1880.

Coniophora atrocinerea Karst., Soc. Faun. Fl. Fenn. Med. **6**: 12. 1881, et apud Thüm. Myc. Univ. *1806.* 1881 (!!); Burt, Missouri Bot. Gard. Ann. **4**: 260. 1917.

Coniophora fumosa Karst., Soc. Faun. Fl. Fenn. Med. **6**: 13. 1881 (!!) ("*Corticium fumosum* Fr. pr.p."; num typus ?); nec *Coniophora fumosa* sensu Massee, Linn. Soc. Bot. Jour. **25**: 139. 1889.

Coniophora umbrina (Fries) Karst., Bidr. Känned. Finl. Nat. Folk **37**: 160. 1882; Burt, Missouri Bot. Gard. Ann. **4**: 256. 1917.

Coniophora olivacea ([Fries] ex Pers.) Karst., Bidr. Känned. Finl. Nat. Folk **37**: 162. 1882; Burt, Missouri Bot. Gard. Ann. **4**: 257. 1917.

Coniophora furva Karst., Bidr. Känned. Finl. Nat. Folk **37**: 244. 1882 (!!).

Coniophora brunneola (Berk. & Curt.) Sacc., Syll. Fung. **6**: 648. 1888.

Coniophora Ellisii (Berk. & Cooke) Sacc., Syll. Fung. **6**: 648. 1888.

Coniophora leucothrix (Berk. & Curt.) Sacc., Syll. Fung. **6**: 648. 1888.

Coniophorella atrocinerea (Karst.) Karst., Bidr. Känned. Finl. Nat. Folk **48**: 438. 1889; Bourd. & Galz., Hymén. de France p. 364. [1928].

Coniophorella olivacea ([Fries] ex Pers.) Karst., Bidr. Känned. Finl. Nat. Folk **48**: 438. 1889; Bourd. & Galz., Hymén. de France p. 362. [1928].

Coniophora Sistotremoides (Schw.) Massee, Linn. Soc. Bot. Jour. **25**: 133. 1889; Burt, Missouri Bot. Gard. Ann. **4**: 249. 1917; **13**: 312. 1926, quantum ad typum.

Coniophora fulvo-olivacea Massee, Linn. Soc. Bot. Jour. **25**: 134. 1889 (!!); Karst., Hedwigia **30**: 300. 1891.

Coniophora Karstenii Massee, Linn. Soc. Bot. Jour. **25**: 134. 1889 (!!).

Coniophorella umbrina (Fries) Bres., Ann Mycol. **1**: 111. 1903; Bourd. & Galz., Hymén. de France p. 363. [1928]; Laurila, Soc. Zool.-Bot. Fenn. Vanamo Ann. Bot. **10**(4): 13. 1939.

Coniophora arida subsp. *fumosa* (Karst.) Bourd. & Galz., Soc. Mycol. Fr. Bul. **39**: 113. 1923; Hymén. de France p. 359. [1928], quantum ad typum.

Coniophorella olivacea subsp. *fulvo-olivacea* (Massee) Bourd. & Galz., Soc. Mycol. Fr. Bul. **39**: 116. 1923; Hymén. de France p. 362. [1928].

Coniophora sibirica Burt, Missouri Bot. Gard. Ann. **18**: 485. 1931 (!!); Pilát, Soc. Mycol. Fr. Bul. **49**: 296. 1933.

Tomentella umbrina (Fries) Litsch., Soc. Mycol. Fr. Bul. **49**: 52. 1933, quantum ad typum; Donk, Nederl. Mycol. Ver. Med. **22**: 29. (= Bot. Mus. Herb. Univ. Utrecht Med. **9**: 29.) 1933, tantundem.

Coniophorella umbrina var. *olivacea* ([Fries] ex Pers.) Rick, Brotéria Sér. Trim. Ciênc. Nat. **3**: 167. 1934.

(*Thelephora umbrina* Pers. var. *lignatilis* Alb. & Schw., Consp. Fung. p. 281. 1805.

(*Hypochnus olivaceus* Fries, Obs. Mycol. **2**: 282. 1818.

(*Coniophora fusca* Karst. ex Thüm., Myc. Univ. *2112*. 1883 (nomen nudum); nec *C. fusca* sensu Massee, Linn. Soc. Bot. Jour. **25**: 139. 1889.

As Laurila has pointed out, *C. atrocinerea*, *C. olivacea* and *C. umbrina* are only stages in the development of a single fungus. In *C. atrocinerea* the color is relatively grayish (lighter than Buffy Brown (R) in the type) and the cystidia are still short and have mostly hyaline or pallid, narrow, unincrusted distal portions (cf. Burt's figure); a few, however, are nearly mature and dark and broad through much of their length. In *C. olivacea* the color is darker and less ashy (Isabella Color (R) in a specimen from Bresadola, between that and Tawny Olive (R) in one from Karsten), partly from darkening of the hymenial elements, and partly from the accumulation of the spores; the cystidia are mature through most of their length, although the tips of the majority are still growing, and still narrow (cf. Burt's figure). In *C. umbrina* the hymenium is still darker (Saccardo's Umber (R) in a specimen from Bresadola), and the cystidia mostly dark throughout and broadened and spatulate at the ends (cf. Burt's figure). Finally, in *C. Sistotremoides* (type) and *C. Karstenii* (type), the cystidia are not only completely darkened but immersed. There are no differences with respect to spores, basidia, or mycelium, nor in the mature portions of the cystidia, except in *C. sibirica*, where the spores are a little smaller and the basal mycelium darker than in most material. Perhaps the majority of collected specimens fall between *C. olivacea* and *C. umbrina*. The affinities of the present fungus with species of *Coniophora* lacking cystidia are very great, and the segregation of *Coniophorella*, of which it is the type, is purely an artificial and mechanical treatment.

Bresadola has attempted to base two species, a *Coniophora* and a "*Hy-*

pochnus," on *T. olivacea;* as has been pointed out by Rogers (l. c.), the description in Fries's "Elenchus," and to a lesser extent also the first valid publication, in Persoon, apply only to the *Coniophora.* A number of authors have likewise attempted to base two species on *T. umbrina.* Thus Burt has a "*Hypochnus umbrinus* (Fries) Burt" and a "*Coniophora umbrina* Alb. & Schw. ex Fries," both based on a description by Fries (Elenchus Fung **1:** 199. 1828.) and both having listed as a synonym *Corticium umbrinum* Fries (Hymen. Eur. p. 658. 1874.). Aside from the absurdity of this double treatment, and from the fact that *H. umbrinus* had already been published by three different authors, the first time at least for quite another fungus, objection to such taxonomy can be made on the grounds of the original description, which, reading "Sporidiis sordide ferrugineis . . . Hinc optima Coniophora. Observantur insuper sub lente setulae fuscae . . ." can apply only to the present species. Furthermore, it is not correct to attribute this *T. umbrina* to Albertini & Schweinitz; their *T. umbrina*, like all the species for which they gave no authority, is the species of Persoon (cf. Consp. Fung. p. vi, vii). To *T. umbrina* Pers., described as terricolous, they added a lignicolous variety which Fries cited under *T. umbrina*, "nec *T. umbrina* Pers." (Elenchus Fung. **1:** 199. 1828.) — that is, the variety is "Alb. & Schw.," but the species is "Fries" as Fries himself wrote it in the index to the "Systema."

CONIOPHORA AVELLANEA Burt = **Corticium confluens** Fries

Thelephora confluens Fries, Syst. Mycol. **1:** 447. 1821.
Corticium confluens (Fries) Fries, Epicr. Syst. Mycol. p. 564. 1838; Burt, Missouri Bot. Gard. Ann. **13:** 220. 1926; Bourd. & Galz., Hymén. de France p. 212. [1928], cum synon. plur.
Hypochnus confluens (Fries) Bon., Handb. p. 159. 1851, quantum ad typum.
Coniophora avellanea Burt, Missouri Bot. Gard. Ann. **4:** 251. 1917 (!!).
Corticium rubellum Burt, Missouri Bot. Gard. Ann. **13:** 232. 1926 (!!).

Burt was apparently led to describe this species as a *Coniophora* by the circumstance that its spore-print is somewhat colored. *Corticium rubellum* is based on a fructification of a strong rosy color, such as is not uncommon in this variable fungus. See Bourdot's discussion of coloration (l. c.).

CONIOPHORA BYSSOIDEA (Pers. ex Fries) Karst. = **Peniophora byssoides** (Pers. ex Fries) Bres.

Thelephora byssoides Pers. ex Fries, Syst. Mycol. **1:** 452. 1821.
Athelia strigosa Pers. β *muscigena* Pers., Mycol. Eur. **1:** 83. 1822.
Hypochnus strigosus β *filamentosus* Wallr., Fl. Crypt. Germ. **2:** 312. 1833.
Corticium lacunosum Berk. & Br., Ann. Mag. Nat. Hist. IV **11:** 343. 1873 (!!).
Corticium byssoideum (Pers. ex Fries) Fries, Hymen. Eur. p. 659. 1874.
Hypochnus byssoideus (Pers. ex Fries) Quél., Soc. Bot. Fr. Bul. **26:** 231. 1879.
Coniophora byssoidea (Pers. ex Fries) Karst., Bidr. Känned. Finl. Nat. Folk **37:** 160. 1882; Burt, Missouri Bot. Gard. Ann. **4:** 263. 1917.
Hypochnus muscorum Schroet. in Cohn, Krypt.-Fl. Schles. **3**(1): 418. 1888 (!).
Hypochnus setosus Schroet. in Cohn, Krypt.-Fl. Schles. **3**(1): 418. 1888 (!).
Tomentella obducens Karst., Bidr. Känned. Finl. Nat. Folk **48:** 421. 1889 (!).
Diplonema sordescens Karst., Bidr. Känned. Finl. Nat. Folk **48:** 430. 1889 (!).

Peniophora sordescens (Karst.) Sacc., Syll. Fung. **9**: 240. 1891.
Hypochnus obducens (Karst.) Sacc., Syll. Fung. **9**: 243. 1891.
Amphinema sordescens (Karst.) Karst., Hedwigia **32**: 61. 1893.
Peniophora byssoides (Pers. ex Fries) Bres. apud Brinkm., Westf. Prov.-Ver. Jahresber. **26**: 130. 1898 (falso ut "byssoidea"); Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzbungsb. **117**, I: 1084. 1908; Bourd. & Galz., Hymén. de France p. 297. [1928].
Zygodesmus pubidus Ellis & Everh., Torr. Bot. Cl. Bul. **27**: 50. 1900 (!!).
Kneiffia Tomentella Bres., Ann. Mycol. **1**: 103. 1903.
Coniophorella byssoidea (Pers. ex Fries) Bres., Ann. Mycol. **1**: 111. 1903.
Peniophora muscorum (Schroet.) Höhn., Ann. Mycol. **3**: 325. 1905.
Peniophora byssoidea subsp. *Tomentella* (Bres.) Bourd. & Galz., Soc. Mycol. Fr. Bul. **28**: 391 [1913]; Hymén. de France p. 297. [1928].
Kneiffia muscorum (Schroet.) Rick, Brotéria Sér. Trim. Ciênc. Nat. **3**: 72. 1934.

This species is a member of *Coniophora* only if that genus be arbitrarily defined so as to include all resupinate Thelephoraceae with smooth tinted spores — such as *Corticium confluens* Fries, *Peniophora incarnata* (Pers. ex Fries) Karst. and its relatives, and species of *Aleurodiscus* — a sense in which no one has ever used it, and as artificial a generic concept as could be imagined.

CONIOPHORA CEREBELLA Pers. = **C. puteana** (Schum. ex Fries) Karst.

Thelephora puteana Schum. ex Fries, Syst. Mycol. **1**: 448. 1821.
Coniophora cerebella Pers., Mycol. Eur. **1**: 155. 1822; Burt, Missouri Bot. Gard. Ann. **4**: 240. 1917; Bourd. & Galz., Hymén. de France p. 358. [1928].
Corticium puteanum (Schum. ex Fries) Fries, Hymen. Eur. p. 657. 1874.
Coniophora puteana (Schum. ex Fries) Karst., Sällsk. Faun. Fl. Fenn. Not. n. s. **6**: 370. 1868.

To judge from the synonymy given by most authors (there being no material at hand to determine what Persoon, Schumacher, or Fries really had), *Coniophora puteana* is the correct name here; both Burt and Bourdot acknowledge the equivalence of *C. puteana* and *C. cerebella.* Many more names have been given to the largely sterile fungus as it occurs on worked timbers.

CONIOPHORA CORRUGIS Burt = **Corticium corruge** (Burt) Burt in sched.

Coniophora corrugis Burt, Missouri Bot. Gard. Ann. **13**: 310. 1926 (!!).
(*Corticium corruge* Burt in sched., in Baker, Pacific Slope Fungi *3570*, nomen nudum; Overh., Mycologia **11**: 249. 1919, nomen nudum.
Corticium corruge (Burt) Burt in sched., nom. ined.

This characteristic species is best considered a *Corticium* with vernicose-pellicular hymenium over a byssoid subiculum. It is probably a member of Bourdot & Galzin's section *Membranacea.* Typical, true species of *Coniophora* have a thick, firm, often lamellate spore-membrane, and an apiculus more or less peg-like in appearance and distinct from the adjacent wall, as though driven in from outside. A hyaline-spored *Coniophora* is quite conceivable. Although its spores are nearly always hyaline, this is not such a species.

CONIOPHORA CORTICOLA Overh. = **C. alboflavescens** (Ellis & Everh.) Höhn. & Litsch.

Corticium alboflavescens Ellis & Everh., Acad. Nat. Sci. Phila. Proc. **1893**: 324. 1894 (!!).
Coniophora alboflavescens (Ellis & Everh.) Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **116, I**: 791. 1907.
Coniophora corticola Overh., Mycologia **30**: 274. 1938 (!!).

C. alboflavescens was included by Burt as a synonym under *Coniophora Polyporoidea* (Berk. & Curt.) Burt (q. v.). It is amply distinct and a good *Coniophora*, while *C. Polyporoidea* is not. It is well described by Overholts (l. c.) as *C. corticola* and is readily recognizable by the globose spores. The spores of *Coniophora Harperi* Burt, which are also globose, are much smaller; those of *Coniophora mustialaensis* (Karst.) Massee are blue (see next item).

CONIOPHORA CYANOSPORA Rogers = **C. mustialaensis** (Karst.) Massee

Hypochnus mustialaensis Karst., Sällsk. Faun. Fl. Fenn. Not. n. s. **8**: 222. 1871 (!!).
Corticium mustialaense (Karst.) Fries, Hymen. Eur. p. 705. 1874.
Lyomyces mustialensis [!] (Karst.) Karst., Bidr. Känned. Finl. Nat. Folk **37**: 154. 1882.
Hypochnopsis mustialensis (Karst.) Karst., Bidr. Känned. Finl. Nat. Folk **48**: 442. 1889.
Coniophora mustialaensis (Karst.) Massee, Linn. Soc. Bot. Jour. **25**: 139. 1889.
Coniophora cyanospora Rogers, Univ. Iowa Studies Nat. Hist. **17**: 25. 1935 (!!).

It is difficult to imagine how Karsten's species could have been compared by Bresadola (Ann. Mycol. **9**: 426. 1911.) with any of the forms which pass as *Odontia*, and even more difficult to see it, as there listed, in the company of *Corticium sulphurellum* Höhn. & Litsch., which is waxy, closely adnate, clear yellow, and hyaline-spored. It differs from *Caldesiella viridis* (Alb. & Schw. ex Fries) Pat., to which Bourdot assigned it (Hymén. de France p. 409. [1928].), in the smooth spore walls and in other respects. *Hydnum Sobolewskii* Weinm. (Flora **15**: 452. 1832.) may well be this species; but the description provides no assurance that the superficially similar *Caldesiella viridis* is not the fungus referred to. *Amaurodon viridis* sensu Schroet. (in Cohn, Krypt.-Fl. Schles. **3** (1): 461. 1888) is probably this species rather than the *Caldesiella*.

With age the darker parts of the fructifications in this species become Grape Green (R) to Vetiver Green (R), the margin remaining about Chartreuse Yellow (R).

CONIOPHORA DRYINA (Berk. & Curt.) Massee = **Peniophora dryina** (Berk. & Curt.) comb. nov.

Corticium dryinum Berk. & Curt., Grevillea **1**: 179. 1873 (!!).
Xerocarpus laeticolor Karst., Bidr. Känned. Finl. Nat. Folk **37**: 137. 1882 (!).
Coniophora crocea Karst., Rev. Mycol. **9**: 10. 1887 (!).
Corticium laeticolor (Karst.) Sacc., Syll. Fung. **6**: 636. 1888.
Coniophora laeticolor (Karst.) Karst., Bidr. Känned. Finl. Nat. Folk **48**: 436. 1889; Burt, Missouri Bot. Gard. Ann. **4**: 261. 1917.
Coniophora dryina (Berk. & Curt.) Massee, Linn. Soc. Bot. Jour. **25**: 135. 1889; Burt, Missouri Bot. Gard. Ann. **4**: 253. 1917.

Peniophora crocea (Karst.) Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **115,** I: 1574. 1906; Bourd. & Galz., Hymén. de France p. 278 [1928].
Peniophora tabacina Burt, Missouri Bot. Gard. Ann. **12:** 334. [1926] (!!).
Coniophorella laeticolor (Karst.) Pilát, Soc. Mycol. Fr. Bul. **49:** 296. 1933.
Peniophora dryina (Berk. & Curt.) comb. nov.

The external appearance of the fungus is that of a *Coniophora,* but the structure of both spores and basidiocarp is quite different, and not essentially different from that of various fungi now assigned to *Peniophora.* The spores in particular are thin-walled and with an apiculus quite different from the peg-like structure of a typical *Coniophora.* Except in older specimens, where most of the elements are somewhat stained, the spore-wall is colorless, such tint as is present arising from the brassy yellow color of the contents. There is no important difference in this respect between specimens assigned by Burt to *Peniophora tabacina* and those assigned to *Coniophora laeticolor.* Fresh material of the species showed only spores with colorless walls; presumably old embedded spores, even in living specimens, would become somewhat stained.

The species is apparently very rare in Europe; neither Massee nor Höhnel & Litschauer nor Bourdot & Galzin report other material than Karsten's two types. In addition to those listed by Burt, American specimens have been seen from Virginia, Missouri, Idaho, and Ontario, and in some numbers from Oregon.

CONIOPHORA FLAVA Burt = **Peniophora flava** (Burt) comb. nov.

Coniophora flava Burt, Missouri Bot. Gard. Ann. **4:** 261. 1917 (!!).
Peniophora flava (Burt) comb. nov.

Readily recognizable, as Burt has pointed out, by the brilliant color, separable membranous texture, and incrusted cystidia. These organs are somewhat unusual in being quite thin-walled throughout, although incrusted at maturity, — not the common situation. They arise as more or less ventricose gloeocystidium-like bodies, and become fusiform with age. The granular coloring material has a brassy-yellow cast like that of *Peniophora dryina* in some phases. The spores are thin- and apparently hyaline-walled, with yellow resinous inclusions, 4.5–6 × 3.5 μ.

CONIOPHORA FLAVOMARGINATA Burt = **Mycoacia Himantia** (Schw.) Miller & Boyle

Clavaria byssacea Roth ex Pers., Mycol. Eur. **1:** 172. 1822; Bourd. & Galz., Soc. Mycol. Fr. Bul. **26:** 216. 1910.
Hydnum Himantia Schw., Nat. Ges. Leipzig Schrift. **1:** 104. 1822.
Hydnum subfuscum Peck, New York State Mus. Rept. **40:** 55. 1887.
Odontia Himantia (Schw.) Bres., Ann. Mycol. **1:** 85. 1903; Brown, Bot. Gaz. **96:** 665. 1935.
Coniophora flavomarginata Burt, Missouri Bot. Gard. Ann. **13:** 311. 1926 (!!).
Clavaria Himantia (Schw.) Bourd. & Galz., Hymén. de France p. 122. [1928].
Oxydontia Himantia (Schw.) Miller, Mycologia **25:** 363. 1933.
Mycoacia Himantia (Schw.) Miller & Boyle, Univ. Iowa St. Nat. Hist. **18:** 44. 1943.
(*Clavaria byssacea* Roth, Usteri Ann. Bot. **1:** 11. pl. 1, fig. 5. 1791.

Burt's fungus has spore-walls thin and colorless or only slightly yellowish, and is certainly not a *Coniophora*. It is very common throughout the autumn and winter in western Washington and Oregon, growing in chinks in the bark of standing trees of *Quercus Garryana*. The scarcity of collections, which drew Burt's comment, is almost certainly attributable to the fact that on this substratum the fungus nearly always appears immature, or abortive. On dead sticks, mosses, and forest litter in the same region the teeth are well developed, and the assignment to Schweinitz's *H. Himantia* is not difficult; such material agrees closely with Roth's description and figure of *C. byssacea*.

From Persoon's description also, *C. byssacea* should be the same as *H. Himantia*, to which it is antecedent by perhaps half a year. Since we have no warrant for taking the asterisk which precedes the name in Persoon as the sure sign of a subspecies (cf. Persoon, Syn. Plant. **1**: x. 1805; and **1**: 174, where names so marked are referred to as species), "byssacea" is probably the correct specific name, rather than "Himantia." The genus is not so readily determined. The fungus is certainly not a *Coniophora* (as in Burt), nor a *Hydnum sensu str.*, nor a *Clavaria* (as in Bourdot & Galzin and in Persoon), nor, in any acceptable sense, an *Odontia*. Whether Donk's *Mycoacia* (or Miller's *Oxydontia*) is a natural genus is a question scarcely within the province of the present paper. It appears doubtful that the fungus under discussion here is congeneric with either *Hydnum setosum* Pers., the type of *Oxydontia*, or *Hydnum fusco-atrum* Fries, the type of *Mycoacia*. However, until the genera of resupinate Hydnaceae can be carefully correlated with appropriate sections or genera of the Thelephoraceae, it will not be possible to make more than a tentative place for this somewhat anomalous species; and for the interim it is as well left under *Mycoacia Himantia*.

Suksdorf *889*, listed as a paratype of Burt's species, is *Aleurodiscus disciformis* (DC. ex Fries) Pat.

CONIOPHORA LAETICOLOR (Karst.) Karst. = **Peniophora dryina** (Berk. & Curt.)

See under *Coniophora dryina* (Berk. & Curt.) Massee

CONIOPHORA POLYPOROIDEA (Berk. & Curt.) Burt = **Corticium Polyporoideum** Berk. & Curt.

Corticium Polyporoideum Berk. & Curt., Grevillea **1**: 177. 1873 (? !!).
Coniophora Polyporoidea (Berk. & Curt.) Burt, Missouri Bot. Gard. Ann. **4**: 247. 1917.
Hypochnus Polyporoideus (Berk. & Curt.) Overh., Mycologia **30**: 275. 1938.

The spores of this species are asperulate and slightly colored, but are not those of a *Coniophora* nor of a *Tomentella*. The species of *Corticium* brought together by Bourdot & Galzin in the section *Humicola* will some day be removed from the genus to their own place and this species will go with them. *Corticium Polyporoideum* differs from the nearest species, *C. albo-ochraceum* Bres., most obviously in the broader, blunt spores.

Coniophora alboflavescens Ellis & Everh., which Burt reduced to synonymy with the present species, is distinct, and a good *Coniophora* (see under *Coniophora corticola* Overh.).

CONIOPHORA SISTOTREMOIDES sensu Burt = **C. suffocata** (Peck) Massee

Corticium suffocatum Peck, New York State Mus. Rept. **30**: 48. 1878 (!!); nec *C. suffocatum* Bourd. & Galz., Soc. Mycol. Fr. Bul. **27**: 263. 1911.
Coniophora suffocata (Peck) Massee, Linn. Soc. Bot. Jour. **25**: 138. 1889; Burt, Missouri Bot. Gard. Ann. **4**: 254. 1917.
Coniophora Sistotremoides sensu Burt, Missouri Bot. Gard. Ann. **13**: 312. 1926; nec *Thelephora Sistotremoides* Schw. (= *Coniophora olivacea* ([Fries] ex Pers.) Karst.)
Hypochnus flavo-brunneus Dearn. & Bisby in Bisby et al., Fungi Manitoba p. 90. 1929 (!!).

Schweinitz's material of *Thelephora Sistotremoides* shows the enormous cystidia and the other characters of *Coniophora olivacea*, and is therefore listed in synonymy with that species. *C. suffocata* Peck may then be revived. Only a slide of Peck's type was available for study, but in it the fungus is well preserved, and there can be little doubt of its microscopic characters. In Bisby et al., The Fungi of Manitoba and Saskatchewan p. 75. 1938, *H. flavo-brunneus* was listed as a synonym of *C. suffocata.* It agrees reasonably well with the type slide. Whether *C. suffocata*, *C. Betulae* (Schum.) Karst., and some of the related species are distinguishable from each other, and from *C. arida* (Fries), is a question whose answer is not attempted at this time. Perhaps the spores in *C. suffocata* are of more even diameter than those of *C. arida.* For *C. Sistotremoides* (Schw.) Massee see under *Coniophora atrocinerea* Karst.

CONIOPHORA UMBRINA (Fries) Karst. = **C. olivacea** ([Fries] ex Pers.) Karst.

See under *Coniophora atrocinerea* Karst.

CONIOPHORA VAGA Burt = **Pellicularia flavescens** (Bon.) Rogers

Coniophora vaga Burt, Missouri Bot. Gard. Ann. **4**: 251. 1917.
Pellicularia flavescens (Bon.) Rogers, Farlowia **1**: 105. 1943, ubi synon.

CORTICIUM

CORTICIUM ABEUNS Burt

Comment on this gloeocystidiate form is included here, not because the species necessarily goes into synonymy, but because we have studied it rather intensively and have found the description misleading and the paratypes confused. The species was described by Burt (Missouri Bot. Gard. Ann. **13**: 250. 1926.) as having copious subglobose spores 6–7 x 4–6 μ. It is evident that this description cannot have been made from the designated type, which is a collection made on coniferous wood by Dr. R. P. Burke at Montgomery, Alabama (Burke *229*). In that collection the spores are 8.5–10.5 x 4.5–5.5 μ, flattened and appearing straight on one side with lateral apiculus; definitely rounded on the opposite side. Another feature not made clear in the description is the

presence of substratal hyphae 2–2.5 μ in diameter which become thick-walled.

These features fit reasonably well the characters of *Gloeocystidium ochroleucum* Bres. ex Bourd. & Galz. (= *Gl. ochroleucum* Bres. & Torrend, nec *Corticium ochroleucum* Fr., nec *C. ochroleucum* Bres.) which was described as on coniferous wood from Portugal. We have seen only collections from France on deciduous-leaved hosts assigned to this species by Bourdot. While these are comparable, we hesitate to combine the species without having seen the type from Portugal. In any case, Burt's specific name is the valid one in *Corticium*.

Of the seventeen paratypes assigned by Burt to this species, only three resemble the type at all closely. These are Atkinson *2595*, Macoun *812*, and Yasuda *12*. We have examined all of the other collections and found that none are comparable with the type. While several of them cannot be identified, the following have been named: the collection from Maine (Murrill *1938*) and two of the British Columbia collections (Macoun *496* and *490*) are all *Corticium porosum* Berk. & Curt.; the New Hampshire (Snell *626*) and the Wisconsin record (Humphrey *617*) are *Corticium livido-caeruleum* Karst.; the two Peck collections from New York are both *Corticium Litschaueri* Burt; and the New Mexico record (Long *21046*) is *Corticium punctulatum* Cooke. None of these species have anything in common with *C. abeuns* except the possession of gloeocystidia. It seems probable that Burt's description was taken largely from the New Mexico collection rather than from the designated type.

CORTICIUM ALBO-STRAMINEUM (Bres.) Overh. = **C. geogenium** Bres.

See under *Peniophora albo-straminea* Bres.

CORTICIUM APICULATUM Bres. = **C. tessulatum** Cooke

Corticium tessulatum Cooke, Grevillea **6**: 132. 1878 (!!); Burt, Missouri Bot. Gard. Ann. **13**: 210. 1926.

Corticium illaqueatum Bourd. & Galz., Soc. Mycol. Fr. Bul. **27**: 238. 1911 (!); Hymén. de France p. 192. [1928]; Burt, Missouri Bot. Gard. Ann. **13**: 236. 1926.

Corticium rhizophorum Bourd. & Galz., Soc. Mycol. Fr. Bul. **27**: 238. 1911 (!).

Corticium apiculatum Bres., Mycologia **17**: 68. 1925 (!!); Burt, Missouri Bot. Gard. Ann. **13**: 238. 1926; Overh., Mycologia **21**: 280. 1929; nec *C. areolatum* Bres., Mycologia **17**: 68. 1925 (!!).

Corticium illaqueatum f. *rhizophorum* (Bourd. & Galz.) Bourd. & Galz., Hymén. de France p. 192. [1928].

While differing considerably in the degree of development of the subiculum, the types of the three species listed above agree so closely in essential microscopic characters that they are best considered all one species, for which the name *C. tessulatum* Cooke has priority.

All of the seven collections cited by Burt as *C. apiculatum* have been examined. None are like the type with the possible exception of the one from British Columbia, which is close but doubtful. The assignment by Burt of *C. areolatum* Bres. (q. v.) as a synonym of *C. apiculatum* Bres. is found to be incorrect. The types of the two species differ widely,

especially in spore characters. Overholts (l. c.) has commented on this species but the collection to which he refers (Overh. *3167*) is *Peniophora albula* Atk. & Burt. (q. v.).

CORTICIUM ARACHNOIDEUM Berk.

See under *Corticium centrifugum* (Lév.) Bres.

CORTICIUM AREOLATUM Bres.

This species, described by Bresadola (Mycologia **17**: 68. 1925.) from a collection made by J. R. Weir on *Alnus tenuifolia* at Priest River, Idaho (Weir *23387*), was listed by Burt (Missouri Bot. Gard. Ann. **13**: 238. 1926.) as a synonym of *C. apiculatum* Bres. (q. v.). Study of the type collection, however, shows that it is amply distinct and appears to be a good species. None of the other collections cited by Burt under *C. apiculatum* are like it. Collections are now at hand, however, from British Columbia on *Salix*, and from Idaho on *Populus*. Several collections made in Ontario on *Thuja occidentalis* seem referable here.

Corticium areolatum Stahel, Phytopath. **30**: 129. 1940, is *Pellicularia filamentosa* (Pat.) Rogers, Farlowia **1**: 113. 1943.

CORTICIUM ATKINSONII Burt = **Trechispora coronifera** (Höhn. & Litsch.) comb. nov.

Gloeocystidium coroniferum Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **116,** I: 825. 1907.

Corticium Atkinsonii Burt, Missouri Bot. Gard. Ann. **13**: 208. 1926.

Trechispora coronifera (Höhn. & Litsch.) comb. nov.
See under *Sistotrema*.

CORTICIUM BERKELEYI Cooke = **Peniophora aspera** (Pers.) Sacc.

? *Thelephora granulosa* Pers. ex Fries, Syst. Mycol. **1**: 446. 1821.

Thelephora aspera Pers., Mycol. Eur. **1**: 153. pl. [5], fig. [4]. 1822.

Hydnum granulosum (Pers. ex Fr.) Pers., Mycol. Eur. **2**: 184. 1825, quantum ad typum Persoonianum.

Thelephora setigera Fries, Elench. Fung. **1**: 208. 1828; Gen. Hymen. p. 17. 1836.

Hyphoderma spiculosum Wallr., Fl. Crypt. Germ. **2**: 576. 1833.

Hyphoderma asperum (Pers.) Wallr., Fl. Crypt. Germ. **2**: 577. 1833.

? *Grandinia granulosa* (Pers. ex Fries) Fries, Epicr. Syst. Mycol. p. 527. 1838; Bourd. & Maire, Soc. Mycol. Fr. Bul. **36**: 74. 1920; Bourd. & Galz., Hymén. de France p. 408. [1928]; Bourd., Soc. Mycol. Fr. Bul. **48**: 217. 1932.

Kneiffia setigera (Fries) Fries, Epicr. Syst. Mycol. p. 529. 1838.

Corticium setigerum (Fries) Karst., Bidr. Känned. Finl. Nat. Folk **37**: 143. 1882.

Corticium myxosporum Karst., Bidr. Känned. Finl. Nat. Folk **37**: 240. 1882 (!!); Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **115,** I: 1555. 1906.

Corticium latitans Karst., Rev. Mycol. **10**: 74. 1888.

Kneiffia latitans (Karst.) Karst., Icon. Sel. **3**: 7. fig. 73. 1889; Laurila, Soc. Zool.-Bot. Fenn. Vanamo Ann. Bot. **10**(4): 10. 1939.

Corticium Berkeleyi Cooke ex Massee, Linn. Soc. Bot. Jour. **27**: 133. 1890 (!!); Burt, Missouri Bot. Gard. Ann. **13**: 183. 1926.

Corticium Chusqueae Pat., Soc. Mycol. Fr. Bul. **9**: 134. 1893 (!!).

Peniophora trachytricha Ellis & Ev., Acad. Nat. Sc. Phila. Proc. **47**: 413. 1895 (!!).

Kneiffiella aspera (Pers.) Underw., Torr. Bot. Cl. Bul. **24**: 206. 1897.

Kneiffiella setigera (Fries) P. Henn. in E. & P., Nat. Pflanzenfam. **1**^{1**}: 140. [1898].

Kneiffiella latitans (Karst.) P. Henn. in E. & P., Nat. Pflanzenfam. **1**[1**]: 141. [1898].

Pycnodon asper (Pers.) Underw., Torr. Bot. Cl. Bul. **25**: 631. 1898 (falso ut 'asperum').

Odontia Acerina Peck, New York St. Mus. Rept. **53**: 847. 1900.

Neokneiffia aspera (Pers.) Earle apud Mohr, U. S. Nat. Herb. Contr. **6**: 203. 1901.

Peniophora setigera (Fries) Höhn. & Litsch., Ann. Mycol. **4**: 289. 1906; Bourd. & Galz., Hymén. de France p. 309. [1928].

Peniophora latitans (Karst.) Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **115**, I: 1554. 1906.

Peniophora aspera (Pers.) Sacc., Fl. Ital. Crypt. Hymen. p. 1182. 1916.

? *Asterostromella granulosa* (Pers. ex Fries) Bourd. & Galz., Hymén. de France p. 396. [1928], saltem quantum ad typum, descr. icon. excl.

Odontia vesiculosa Burt ex Povah, Mich. Acad. Papers **9**: 262. 1929 (!!).

Odontia setigera (Fries) Miller, Mycologia **26**: 19. 1934.

Kneiffia setigera var. *trachytricha* (Ellis & Ev.) Rick, Brotéria Sér. Trim. Ciênc. Nat. **3**: 70. 1934.

? *Vararia granulosa* (Pers. ex Fries) Laurila, Soc. Zool.-Bot. Fenn. Vanamo Ann. Bot. **10**(4): 15. 1939.

(*Thelephora granulosa* Pers., Syn. Meth. Fung. p. 576. 1801.

The type collection of *Corticium Berkeleyi* was distributed in Ravenel's Fungi Americani *225;* material in three different sets of this work, including a fragment in Burt's own herbarium, is the same fungus as that described by Bourdot & Galzin and by Miller as, respectively, *Peniophora setigera* and *Odontia setigera.* In his account of *C. Berkeleyi* Burt makes no mention of the minutely papillose hymenium nor of the very large, septate cystidia which are, nevertheless, clearly present. It therefore appears that Burt drew up his description not from the type but from quite different specimens present in his herbarium, specimens of a fungus closely allied to *Corticium bombycinum* (Somm.) Karst. Whatever decision is finally reached concerning *C. Berkeleyi* sensu Burt, there is no doubt concerning the status of *C. Berkeleyi* Cooke.

Determination of the correct name for the latter fungus is not a simple matter. Bourdot has reported (l. c., 1932) that Persoon's type of *T. granulosa* is the same as *P. setigera.* The simplest manner of dealing with the problem would then be to adopt a binomial formed from *T. granulosa* Pers. ex Fries, the earliest valid name in the long synonymy of the species. But so many fungi have been identified (incorrectly) with *T. granulosa* and *G. granulosa* that the use of the name (even though correctly) for another species would be bound to result in considerable confusion. This is good but insufficient reason for rejecting the epithet "granulosa." What is more important is that it is not allowable to define *T. granulosa* merely from Persoon's concept and his specimen; that species was "validated" (as some would have it) by publication in Fries's "Systema," and must forever be seen through Fries's eyes. Now in the "Epicrisis" and again in the "Hymenomycetes Europaei," Fries wrote (under *G. granulosa*) that his concept "includes several species . . . ; I have now before my eyes the noblest form, the var. *ochracea* of Albertini & Schwei-

nitz." Whatever may have been Persoon's species, then, Fries's was an omnium gatherum, incapable of definition and typified by nothing or, if "noblest form" can be translated "type," by an alien fungus. It is therefore hereby proposed that *Thelephora granulosa* Pers. ex Fries be considered a nomen dubium and that it and all binomials based on it be dropped from mycological nomenclature.

Thelephora aspera Pers. was repeatedly acknowledged by Fries, as well as by later authors, as identical with *T. setigera* Fries; the account of the latter in the "Elenchus," and of *Kneiffia setigera* in the "Hymenomycetes Europaei," may in this connection well be compared with Persoon's description of *T. aspera*. On Fries's authority, then, *P. aspera* is the correct name for the present species so long as it is retained in *Peniophora*.

CORTICIUM BOTRYOIDEUM Overh. = **Pellicularia pruinata** (Bres.) Rogers

Corticium botryoideum Overh., Mycologia **26**: 510. 1934.
Pellicularia pruinata (Bres.) Rogers ex Linder; Rogers, Farlowia **1**: 107. 1943, ubi synon.

CORTICIUM CALCEUM sensu Romell & Burt Nomen confusum.

(*Thelephora calcea* Pers. * *glebulosa* Fries, Elenchus Fung. **1**: 215. 1828 (!!).
(*Corticium glebulosum* (Fries) Bres., Fungi Trident. **2**: 61. 1898.
(*Peniophora glebulosa* (Fries) Sacc. & Syd., Syll. Fung. **16**: 195. 1902; Burt, Missouri Bot. Gard. Ann. **12**: 282. [1926]; Bourd. & Galz., Hymén. de France p. 288. [1928].
(*Kneiffia glebulosa* (Fries) Bres., Ann. Mycol. **1**: 104. 1903.
(*Corticium calceum* sensu Romell & Burt, Missouri Bot. Gard. Ann. **13**: 203. 1926; nec *C. calceum* (Pers.) Fries, Epicr. Syst. Mycol. p. 562. 1838. (= *Thelephora calcea* Pers., Mycol. Eur. **1**: 153. 1822).
(*Peniophora cretacea* Bourd. & Galz., Hymén. de France p. 288. [1928].

All of the names here listed are based either directly on the type specimen of *T. calcea* * *glebulosa* or else on that name as published by Fries and hence indirectly on its type. It is now evident, as Bourdot's description and figure of *P. cretacea* strongly suggest, as Litschauer has clearly stated (Svensk. Bot. Tidskr. **32**: 285. 1938; cf. also Lund. & Nannf., Fungi Exs. Suecici *465*. 1937, and Litsch., Ann. Mycol. **39**: 134. 1941), and as examination of the material itself fully confirms, that Fries's type consists of the cystidiolate *Peniophora Romellii* growing over the cystidiate fungus which has since 1902 been treated under the name *Peniophora glebulosa*. Burt has denied that any cystidia are present in this specimen; but his own slides show them. *Thelephora calcea* * *glebulosa* and all its synonyms here listed are *nomina confusa*, not applicable to any one organism. (cf. *Peniophora glebulosa* sensu Bres.).

It can be deduced from the above, since Burt did not observe the cystidia in the designated type, that his intended concept of "*C. calceum* Fries emend. Romell and Burt" was to apply to the cystidiolate component of the complex, which is a clearly identifiable species now properly called *Peniophora Romellii* Litsch. (ex Bourd., Soc. Mycol. Fr. Bul. **48**: 212. 1932 = *Corticium cretaceum* Romell ex Lund. & Nannf., Fungi Exs. Suec.

465. 1937; nec *C. cretaceum* [Fries] Cooke ex Sacc., Syll. Fung. **11**: 128. 1895, quod *Thelephora cretacea* Fries, Obs. Mycol. **1**: 153. 1815.). This is borne out by an examination of the Swedish collections cited by Burt and made by Romell or Romell and Burt. The two joint collections and Romell's *321*, *322*, and *325*, together with one uncited Romell collection *323*, are all *P. Romellii*, which is evidently common in Sweden. On the other hand, three of Romell's collections: *185*, *211*, and *324*, together with 8 (? plus 3 poor and somewhat uncertain) of the 22 American collections cited are *Corticium furfuraceum* Bres. (Mycologia **17**: 69. 1925 (!!); Burt, Missouri Bot. Gard. Ann. **13**: 242. 1926; = *C. subpallidulum* Litsch., Svensk. Bot. Tidskr. **32**: 284. 1938 (!!); cf. also Lund. & Nannf., Fungi Exs. Suecici No. *571*. 1938.).

P. Romellii is apparently rare in North America and does not appear among the American collections cited by Burt; this, together with the fact that half the American collections are as stated above, tends to confirm Litschauer's statement (l. c.) that Burt's description, and hence his actual concept, more nearly fits *C. subpallidulum* (i. e. *C. furfuraceum* Bres.) than *C. cretaceum* Romell in sched. (i. e. *P. Romellii* Litsch.). It is worthy of note that neither Burt nor Bresadola mentioned in their descriptions the highly characteristic capitate cystidioles so well described and figured (as *Köpfchenparaphysen*) by Litschauer for *C. subpallidulum* (l. c.).

The remaining American collections cited by Burt show little consistency. Four of them (the three Canadian collections made by Macoun and one of the Vermont collections) prove to be a possibly undescribed *Peniophora* related to *P. livida* Burt and extremely common in Ontario. Three of the six New York collections (Peck *9*, *20*, and Atkinson *941*) are *Corticium suecicum* Litsch. (apud Lund. & Nannf., Fungi Exs. Suecici *464*. 1937; = *C. calceum* sensu Bourd. & Galz., Hymén. de France p. 237. [1928]). The Wisconsin record (Harper *853*) is *C. incrustans* Höhn. & Litsch.; the Pennsylvania collection (Overh. *4809*) has coronate Urnigera basidia, and two others (Michigan, Humphrey *1662*, and Idaho, Weir *6350*) cannot be identified.

Both *C. furfuraceum* and *P. Romellii* are cystidiolate but since it is a matter of indifference, at present, whether such forms be included in *Corticium* or *Peniophora*, neither is here transferred.

The true *Corticium calceum* (Pers.) Fries is, according to Bresadola, who indicates by an exclamation point that he has seen Persoon's material, *Sebacina calcea* (Pers.) Bres. (cf. McGuire, Lloydia **4**: 23. 1941.).

CORTICIUM CANUM Burt = **C. Galzini** Bourd.

Corticium Galzini Bourd., Rev. Sc. Bourb. **23**: 11. 1910; Bourd. & Galz., Hymén. de France p. 194. [1928] (!).
Corticium canum Burt, Missouri Bot. Gard. Ann. **13**: 206. 1926 (!!).

C. Galzini is included in the group *Pellicularia* of Bourdot & Galzin. Bourdot's description gives the spore measurement as 3–4.5 x 1.25–2.5 μ.

An examination of several collections assigned to this species from the Bourdot herbarium shows considerable variation in spore size and shape. The type collection of *C. canum* Burt has spores 3.5–4.5 x 2–3 μ, slightly broader than any European collection we have seen. The variation is so slight, however, that it seems unnecessary and undesirable to attempt to recognize another species in this characteristic but very difficult group of species.

Eight paratypes are listed by Burt for *C. canum*. Of these only one, Humphrey *6375*, is like the type. The others are as follows: Atkinson *2563* is *Corticium coronilla* Höhn. (q. v.); Langlois *168* is *Corticium sphaerosporum* (R. Maire) Höhn. & Litsch.; Weir *21* is *Corticium lacteolum* Bourd.; Humphrey *6413* is *Corticium microsporum* (Karst.) Bourd. & Galz.; Weir *11101* is *Corticium furfuraceum* Bres.; Shear *1063* and Weir *447* have not been determined but are none of these.

CORTICIUM CENTRIFUGUM (Lév.) Bres. Untenable.

The taxonomy of those species of *Corticium* sect. *Pellicularia* Bourd. & Galz. which cluster about *C. arachnoideum* sensu Bres. and *C. centrifugum* sensu Bres. can be finally reduced to a satisfactory system only by comparative study of large numbers of specimens; and such relative finality has as yet been attained by no one. Since several of the names involved in this complex are in common use it has seemed desirable to include in these notes as clear a statement of the general situation as is possible, without attempting any solution at this time. As a basis for the discussion which follows a list of the names which must be considered is given below together with the essential references, arranged chronologically.

? *Corticium arachnoideum* Berk., Ann. Mag. Nat. Hist. **13**: 345. 1844 (!); Massee, Linn. Soc. Bot. Journ. **27**: 135. 1890; nec *C. arachnoideum* sensu Bres.; Burt, Missouri Bot. Gard. Ann. **13**: 184. 1926; et auctt.

? *Hypochnus centrifugus* Tul., Sel. Fung. Carpol. **1**: 114. 1861. Vix *Rhizoctonia centrifuga* Lév., Ann. Sc. Nat. Bot. II. **20**: 225. 1843.

Hypochnus bisporus Schroet. in Cohn, Krypt.-Fl. Schles. **3**(1): 415. 1888 (2 Jun.).

Corticium Pezizoideum Ellis & Everh., Jour. Mycol. **4**: 74. 1888 (Aug.) (!!); nec *C. Pezizoideum* (Schw.) Schrenk, Torr. Bot. Cl. Bul. **21**: 388. 1894.

Corticium centrifugum sensu Bres., Ann. Mycol. **1**: 96. 1903; Höhn., Österr. Bot. Zeitschr. **54**: 427. 1904; Ann. Mycol. **3**: 188. 1905; Burt, Missouri Bot. Gard. Ann. **13**: 206. 1926; Bourd. & Galz., Hymén. de France p. 197. [1928]; nec *C. centrifugum* (Weinm.) Fries, Hymen. Eur. p. 658. 1874 (= *Thelephora centrifuga* Weinm., Hymen. Gasterom. Ross. p. 392. 1836; *Coniophora centrifuga* (Weinm.) Karst., Bidr. Känned. Finl. Nat. Folk **37**: 160. 1882).

Corticium bisporum (Schroet.) Höhn. & Litsch., Ann. Mycol. **4**: 289. 1906; Bourd. & Galz., Soc. Mycol. Fr. Bul. **27**: 240. 1911; Wakef. & Pears., Br. Mycol. Soc. Trans. **8**: 216. 1923.

Corticium decipiens Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **117**, I: 1116. 1908 (!!).

Corticium consimile Bres., Mycologia **17**: 68. 1925 (!!).

Corticium centrifugum var. *soredioides* Bourd. & Galz., Soc. Mycol. Fr. Bul. **27**: 240. 1911; Hymén. de France p. 198. [1928].

Corticium centrifugum var. *macrospora* Bourd. & Galz., Soc. Mycol. Fr. Bul. **27:** 240. 1911; Hymén. de France p. 198. [1928].

Corticium centrifugum subsp. *fugax* Bourd. & Galz., Hymén. de France p. 198. [1928]. (*Tomentella fugax* Karst. in sched., ex Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **116,** I: 1572. 1906, pro synon.).

Corticium centrifugum subsp. *bisporum* (Schroet.) Bourd. & Galz., Hymén. de France p. 199. [1928].

Corticium centrifugum var. *tenuis* Donk, Nederl. Kruidk. Arch. **1930:** 84. 1930. Non *Fusisporium Kuhnii* Fckl., Fung. Rhen. Suppl. Fasc. 5, *1920.* 1867 (!!); Symb. Mycol. p. 371. 1869.

An analysis of this series indicates that this much is clear: 1) The name *C. centrifugum* is untenable (since *C. centrifugum* Fries must be a *Coniophora* or a *Serpula* [= *Gyrophana*]). 2) There is probably no relation between *R. centrifuga* Lév. and any of the fungi to which the name *C. centrifugum* has been applied by mycologists. 3) *H. centrifugus* Tul. (Léveillé's publication being invalid for any perfect basidiomycete) was probably quite a different thing from the *Corticium* with which Bresadola identified it ("flocci septis illis frequentissime utuntur quae ampulla laterali aucta videntur . . . nempe geniculat[i] seu imperfecte articulat[i]" — Tulasne, l. c.). 4) The one specimen at hand determined by Bresadola as *C. centrifugum* agrees extremely well with Schroeter's description of *H. bisporus,* in having bisporous basidia, as in other points. 5) Of two authentic specimens of *C. arachnoideum* (either, or perhaps each, being possibly a part of the type), neither is the fungus identified with *C. arachnoideum* by Bresadola and later authors. One (in the general collections of the Farlow Herbarium) bears perfect basidia and is *C. octosporum* Schroet. (i. e., *Trechispora Brinkmanni* (Bres.)). The other (in the Curtis collection), with a few mature basidia but no recognizable spores, has no clamps whatever, and in all visible respects but this lack of clamps and the presence of four sterigmata to the basidium is similar to Bresadola's specimen of *C. centrifugum* (cf. Rea, Br. Basid. p. 676. 1922, where *C. centrifugum* is treated as a synonym of *C. arachnoideum*). 6) *C. Pezizoideum* and *C. decipiens* differ only in size, the former having all elements approximately twice as large as in the latter. 7) *Fusisporium Kuhnii* is as described by Fuckel, and not, as Höhnel has stated, *C. centrifugum.* 8) A considerable series of specimens examined includes most of the variations which characterize Bourdot's subspecies and varieties; but these characters are recombined in so many ways that scarcely any two specimens agree, and only rarely can a collection be surely identified with one of the described subdivisions. 9) *Corticium consimile,* based on a single collection made on *Larix occidentalis* by J. Weir (*10808*) in Idaho, was omitted from Burt's treatment of the genus. It is close to *Corticium centrifugum sensu* Bres. as that species is usually understood, differing chiefly in the complete absence of clamps. Bresadola's type is identical with a specimen of *Corticium decipiens* determined by Litschauer, but differs from the type of that species in thicker and less clavate basidia, shorter-celled and wider-branching mycelium, and more ellipsoid and less flattened spores.

Attempts at segregation from the complex should be made only after considerable further study, and on a number of correlated characters. For example, unless an indubitable Berkeley type can be shown to have clamps throughout (and basidia not Urnigera-like), *C. arachnoideum* cannot be separated on the possession of abundant clamps. Presence or absence of rare clamps on the basal mycelium is a difficult and probably not valid basis of segregation of a species from *C. decipiens* (and *C. Pezizoideum*); in some specimens the first clamp has been demonstrated only after a search of twenty minutes. Another anomaly is that 2-spored material (i.e., *C. bisporum sensu stricto*) shows clamps, where 4-spored (e.g., *C. decipiens*) may not. It is quite possible that there may be no natural planes of cleavage within the group. The available valid names include *C. arachnoideum, C. bisporum, C. Pezizoideum, C. decipiens,* and *C. consimile.* As a temporary expedient the oldest available combination, *C. bisporum,* might be used as a name under which to file collections belonging in this complex. If one objects to including 2-spored forms with those having 4-spored basidia in the same species, *C. bisporum* could be used for the former and *C. Pezizoideum* for the latter. Conceivably *C. arachnoideum* (*non sensu* Bres.) might replace *C. Pezizoideum,* or both names, when Berkeley's type specimen is settled upon and examined.

CORTICIUM CONFINE Bourd. & Galz. sensu Burt

Only one American collection is recorded by Burt (Missouri Bot. Gard. Ann. **13**: 246. 1926.) under this name. An examination of this collection (from Middlebury, Vermont) in the Burt herbarium shows that it is *Trechispora coronifera* (Höhn. & Litsch.). The description was obviously taken from the Vermont collection and not from the Bourdot collections cited. So far as the Burt record is concerned this species may be stricken from the North American flora.

CORTICIUM CONSIMILE Bres.

This species was omitted from Burt's treatment of the genus. See under *Corticium centrifugum* (Lév.) Bres.

CORTICIUM CORONILLA Höhn. = **Trechispora Brinkmanni** (Bres.) comb. nov.

Corticium coronilla Höhn., Biggs, Mycologia **29**: 686. 1937; Dodge, Mycologia **30**: 133. 1938.

Odontia Brinkmanni Bres., Ann. Mycol. **1**: 88. 1903.

Trechispora Brinkmanni (Bres.) comb nov.

See under *Sistotrema.*

CORTICIUM CRUSTACEUM (Karst.) Karst. = **C. contiguum** Karst.

Corticium contiguum Karst., Soc. Faun. Fl. Fenn. Acta **2**(1): 39. 1881 (!!); Bidr. Känned. Finl. Nat. Folk **37**: 150. 1882.

Xerocarpus crustaceus Karst., Hedwigia **35**: 45. 1896 (!!).

Stereum crustaceum (Karst.) Sacc. & Syd., Syll. Fung. **14**: 215. 1899.

Corticium crustaceum (Karst.) Karst., Bidr. Känned. Finl. Nat. Folk **62**: 93. 1903; Burt, Missouri Bot. Gard. Ann. **13**: 196. 1926; Bourd. & Galz., Hymén. de France p. 211. [1928]; Laurila, Soc. Zool.-Bot. Fenn. Vanamo Ann. Bot. **10**(4): 5. 1939.

Gloeocystidium contiguum (Karst.) Bourd. & Galz., Soc. Mycol. Fr. Bul. **28:** 362. [1913]; Hymén. de France p. 255. [1928], saltem quantum ad typum.
Corticium subcinereum Burt, Missouri Bot. Gard. Ann. **13:** 277. 1926 (!!).

The original description of *C. contiguum* reads as follows: "Hymenium contiguum, calceum; sporae longit. 4–6 mmm., crassit. 3–4 mmm. Ad lignum Juniperi." In the second reference a redescription in Swedish is given which, translated, reads as follows: "Fruiting layer coherent, chalk color, spores abundant. On Juniper wood. Finland (Mustiala) . . . Effused, adnate, waxy, the periphery similar: spores oval, 4–6 mmm. long, 3–4 mmm. broad." It should be noted that both descriptions give the substratum as Juniper wood. It is evident that these descriptions cannot refer to the species described as *Gl. contiguum* by Bourdot & Galzin.

In the herbarium of the New York Botanical Garden (Ellis collection) there is a specimen labeled, in Karsten's hand, "*Corticium contiguum* Karst. Mustiala, ad Juniperinum. Aug. 1866. P. A. Karsten." An examination of this specimen, which may be considered part of the type, reveals that the substratum is not *Juniperus* as Karsten himself labeled it, but is the wood of some deciduous-leaved tree, and the fungus is identical with the better known *Corticium crustaceum* Karst. which occurs chiefly, if not exclusively, on broad-leaved trees. Laurila (l. c.) lists *C. contiguum* under *C. crustaceum*, with the qualification: "sensu Karstenii pro max. parte." Two of four collections of *C. contiguum* from Karsten's herbarium which we have examined are the same as *C. crustaceum*. A third is *C. porosum* Berk. & Curt. (see under *C. stramineum* Bres.), which may have been the same as the "Specim. orig.!" to which Bourdot & Galzin refer in the second line of their account of *Gl. contiguum*. The fourth is *Gloeocystidium Karstenii* Bourd. & Galz. (Hymén. de France p. 254. [1928] = *Corticium ochraceum* sensu Karst.; nec *C. ochraceum* Fries). With this evidence before us we can see no alternative to replacing *C. crustaceum* Karst. with *C. contiguum* Karst.

The published type of *C. subcinereum* Burt (Macoun *37*) is certainly typical *C. crustaceum*. The description, however, does not well describe the type specimen. In the Burt herbarium two specimens are marked "type" in Burt's hand. One of these is the Kansas collection (Bartholomew *8702*) cited by Burt. It is evident that the description was drawn from the Kansas collections, which are all alike, and which would appear to represent a form of *Peniophora cinerea* (Pers. ex Fries) Cooke in which the cystidia are not developed. The Massachusetts collection cited by Burt is a grandinioid *Corticium* with rough spores.

CORTICIUM CRUSTULINUM Burt = **C. amianthinum** Bourd. & Galz.

Corticium amianthinum Bourd. & Galz., Soc. Mycol. Fr. Bul. **27:** 260. 1911 (!).
Corticium crustulinum Burt, Missouri Bot. Gard. Ann. **13:** 209. 1926 (!!); nec *C. crustulinum* Bres., Ann. Mycol. **18:** 47. 1920.
Corticium albo-ochraceum subsp. *amianthinum* (Bourd. & Galz.) Bourd. & Galz., Hymén. de France p. 231. [1928] (ut '*amiantinum*').

One of the small number of species characterized by ampulliform swellings on the mycelium. The brittle yellow crust formed by the hymenium and subhymenial hyphae is somewhat thicker than in the authentic specimen of *C. amianthinum*, and the subicular mycelium is on the average somewhat more slender; but the differences seem too slight to justify nomenclatorial recognition. Bourdot's species is certainly related to *C. albo-ochraceum* Bres. but differs, according to the material at hand, in having abundant rather than scanty subiculum, in crustose rather than hypochnoid hymenium, in size of spores and basidia, and in spores even-walled (at least, typically) and colorless rather than asperulate and brownish.

CORTICIUM EFFUSCATUM Cooke & Ellis = **Vararia effuscata** (Cooke & Ellis) comb. nov.

Corticium effuscatum Cooke & Ellis, Grevillea **9**: 103. 1881 (!); Burt, Missouri Bot. Gard. Ann. **13**: 248. 1926.
Asterostromella effuscata (Cooke & Ellis) Bourd. & Galz., Hymén. de France p. 396. [1928].
Vararia effuscata (Cooke & Ellis) comb. nov.

Since poorly differentiated dichophyses, such as occur in this species, are not always clearly distinguishable from dendrophyses, the presence of these bodies alone might not constitute sufficient grounds for including *C. effuscatum* in *Vararia*. However, the basidia here are of a sort apparently found in no other group — ventricose, elongate, emergent far beyond the surface of the hymenium, and bearing slender erect sterigmata; in addition to the gloeocystidia there are present thin-walled, acute cystidia with homogeneous content; in these points, and in the spores, it agrees with other indubitable species of *Vararia*. Such coordination of characters is conclusive where a single one might not be.

CORTICIUM EFFUSUM Overh. = **Stereum Murraii** (Berk. & Curt.) Burt

Thelephora Murraii Berk. & Curt., Linn. Soc. Bot. Jour. **10**: 329. 1868 (!!).
Corticium Murrayi (Berk. & Curt.) Pat. apud Duss, Fl. Crypt. Antilles Fr. p. 228. 1904.
Stereum Murraii (Berk. & Curt.) Burt, Missouri Bot. Gard. Ann. **7**: 131. 1920, ubi synon. (falso ut "Murrayi").
Corticium effusum Overh., Mycologia **22**: 238. 1930 (!!).
Stereum Murraii fa. *tuberculosum* (Fries) Pilát, Czech. Acad. Agr. Ann. **5**: 399. 1930.

The difference in appearance of the type collection of Overholts's species from that of typical specimens of *Stereum Murraii* is best attributed to occurrence on much decayed decorticated wood, and to age. The collection is evidently young, just beginning to sporulate. The gloeocystidia in the hymenium are elongated vesicular bodies and their occurrence may be duplicated in the type of *Stereum Murraii* and in other collections. The essential microscopic details are identical in the two forms.

CORTICIUM ERMINEUM Burt = **Aleurodiscus amylaceus** (Bourd. & Galz.) comb. nov.

Corticium amylaceum Bourd. & Galz., Soc. Mycol. Fr. Bul. **27**: 259. 1911 (!); Hymén. de France p. 228. [1928].
Corticium ermineum Burt, Missouri Bot. Gard. Ann. **13**: 182. 1926 (!!); Overh., Mycologia **21**: 280. 1929.
Corticium sociatum Burt, Missouri Bot. Gard. Ann. **13**: 192. 1926 (!!).
Aleurodiscus amylaceus (Bourd. & Galz.) comb. nov.

A comparison of an authentic collection of *C. amylaceum* Bourd. & Galz. (probably a portion of the type) made by Galzin (*6803*) on *Juniperus* (ex Herb. H. Bourdot, Champ. de l'Aveyron *7490*), with the types of the two species described by Burt leaves no doubt that all should be assigned to the same species. The differences noted by Burt in his discussion under *C. ermineum* disappear when a series of specimens are compared. In addition to the types of *C. ermineum* and *C. sociatum* eight collections on *Thuja plicata* from the western United States (Oregon, Montana, Idaho) and British Columbia, together with three collections on *Thuja occidentalis* from widely separated localities in Ontario, have been available for study in the University of Toronto herbarium. This series of specimens shows considerable variation in gross appearance attributable primarily to differences in thickness and age. Burt stresses the absence of clamp connections in both species described by him. Clamps are, however, present in each of the type collections.

As in the case of *Corticium subgiganteum* Berk. (q. v.), it is the type of basidium that is of paramount importance in deciding the generic position of *C. amylaceum*, not the absence of some especially distinctive type of paraphysis. The species is readily recognized by the thin white or cream fructifications, pelliculose or thin membranous hymenium, basidia of the type characteristic of *Aleurodiscus* accompanied by hyphal paraphyses, and the copious amyloid spores which are broadly ellipsoid, 8–12 x 5–8 μ.

Burt assigned a collection made in Vermont on coniferous wood to *C. ermineum*. This collection proves to be *Corticium geogenium* Bres. (see under *Peniophora albostraminea* Bres.). A collection from Manitoba assigned to *C. sociatum* by Burt, while certainly not this species, has not yet been identified.

CORTICIUM FENESTRATUM Overh. = **Pellicularia flavescens** (Bon.) Rogers

Corticium fenestratum Overh., Mycologia **26**: 510. 1934.
Pellicularia flavescens (Bon.) Rogers, Farlowia **1**: 105. 1943, ubi synon.

Corticium fuscostratum Burt and C. OCHROLEUCUM Bres.

Corticium ochroleucum Bres., Fungi Trident. **2**: 58. 1898 (!); Bourd. & Galz., Hymén. de France p. 193. [1928]; nec *C. ochroleucum* (Fries) Fries, Epicr. Syst. Mycol. p. 557. 1838; nec *C. ochroleucum* (Noack) Burt ex Peltier, Univ. Ill. Agric. Exp. Sta. Bul. **189**: 290. 1915.
Corticium fuscostratum Burt, Missouri Bot. Gard. Ann. **13**: 299. 1926 (!!).

Because of the earlier use of the name by Fries, Burt's binomial takes

precedence over *C. ochroleucum* Bres., the name currently used in Europe for this common species.

CORTICIUM ILLAQUAETUM Bourd. & Galz. = **C. tessulatum** Cooke

See under *Corticium apiculatum* Bres.

Burt (Missouri Bot. Gard. Ann. **13:** 236. 1926.) recorded but one American collection (Langlois *203*). While agreeing with thicker forms of this species in general appearance, this shows spores cylindrical rather than subpyriform and the identification is doubtful.

CORTICIUM INCANUM Burt = **C. Tulasnelloideum** Höhn. & Litsch.

Corticium Tulasnelloideum Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **117,** I: 1118. 1908 (!!); Bourd. & Galz., Hymén. de France p. 235. [1928]; Rogers, Univ. Iowa Studies Nat. Hist. **15**(3): 20. 1933.

Corticium incanum Burt, Missouri Bot. Gard. Ann. **13:** 205. 1926 (!!).

Hypochnus Tulasnelloideum (Höhn. & Litsch.) Rea, Br. Mycol. Soc. Trans. **12:** 222. 1927.

Of the six paratypes of *C. incanum* cited by Burt, none are like the type. Two of the Canadian records, Macoun *34* and *36*, are *Corticium coronilla* Höhn., as is the North Carolina collection (Couch *4225*). The New York record collected by House is close to *C. sphaerosporum* (R. Maire) Höhn. & Litsch. The third Canadian collection, Macoun *32*, is a possibly undescribed *Corticium* belonging in the section *Athele* of Bourdot & Galzin. The collection from Vermont has not been identified.

The species is, however, a common one having a wide range in North America. Specimens are now at hand from Quebec, Ontario, British Columbia, New Hampshire, Massachusetts, Connecticut, Rhode Island, New York, New Jersey, Georgia, Ohio, Iowa, Missouri, and Oregon.

CORTICIUM INVESTIENS (Schw.) Bres. = **Vararia investiens** (Schw.) Karst.

Radulum investiens Schw., Am. Phil. Soc. Trans. n. s. **4:** 165. [1832] (!!).

Corticium alutarium Berk. & Curt., Grevillea **2:** 4. 1873 (!!).

Xerocarpus alutarius (Berk. & Curt.) Karst., Bidr. Känned. Finl. Nat. Folk **48:** 418. 1889.

Thelephora subochracea Peck, New York State Mus. Rept. **46:** 109. 1893 (!!).

Corticium investiens (Schw.) Bres., I. R. Accad. Agiati Atti III **3:** 110. 1897; Burt, Missouri Bot. Gard. Ann. **13:** 283. 1926.

Vararia investiens (Schw.) Karst., Bidr. Känned. Finl. Nat. Folk **62:** 96. 1903; Martin, Iowa Acad. Sci. Proc. **44:** 48. [1938].

Asterostromella investiens (Schw.) Höhn. & Litsch., K. Akad. Wiss. Wień Math.-Nat. Kl. Sitzungsb. **117,** I: 1083. 1908; Bourd. & Galz., Hymén. de France p. 395. [1928].

(*Vararia alutaria* (Berk. & Curt.) Karst., Soc. Faun. Fl. Fenn. Med. **16:** 2. 1888, nomen nudum (genus nondum descriptum).

(*Langloisula spinosa* Ellis & Everh., Jour. Mycol. **5:** 68. pl. 10, fig. 1, 2. 1889 (!!) (? nomen confusum); Höhn., K. Acad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **128,** I: 537. 1919.

The genus *Langloisula* was published for what Ellis believed to be a member of the Mucedineae; nevertheless, as von Höhnel was able to judge from the published figure, the specimen collected by Langlois shows the

dichophyses characteristic of an *Asterostromella*. Furthermore, the type both superficially and in its dichophyses, hyphae, and occasional thin-walled cystidia does not differ greatly from *Radulum investiens* Schw. What appear to be immature basidia are present but basidiospores are apparently wanting; even so, there is reasonable evidence that Schweinitz's species is the one present in the Langlois collection. The thick-walled colored conidia described by Ellis occur abundantly, borne singly at the ends of usually long pedicels; but even after long-continued examination it has not been possible to demonstrate a connection between them and the mycelium of the basidiomycete, nor on any of their pedicels the clamps that characterize the hyphae of *R. investiens*. These conidia resemble the spores of *Chromosporium viride* Corda sufficiently to suggest that the parasitic component may be a species of *Chromosporium*. Furthermore, the fructification is (as noted by Ellis) brittle, as though disintegrating, in contrast to the moderately tenacious hymenium ordinarily found in this species, and there are other indubitable hyphomycetes present. It is therefore probable, although far from proved, that Langlois's specimen consists of parasitized material, and that Ellis's generic and specific diagnoses took about equal cognizance of the fungus host and its most conspicuous parasite. Under the circumstances it seems best for the present to consider both *Langloisula* and *L. spinosa* to be *nomina confusa*, and to retain the later name *Vararia*.

Vararia was originally published by Karsten as a subgenus of *Xerocarpus*, for the single species *X. alutarius* (l. c.). When he elevated the group to the rank of genus it still contained only the single species, this time treated under the older specific name "*investiens*." Since *Asterostromella* has the same type (l. c.) it can be only a synonym of Karsten's genus. Most authors have used the later name: Donk (Nederl. Mycol. Ver. Med. **18–20:** 191. 1931.) and Laurila (Soc. Zool.-Bot. Fenn. Vanamo Ann. Bot. **10**(4): 15. 1939.) have properly used *Vararia;* Burt has scattered the species among *Corticium*, *Peniophora* and *Hypochnus;* Overholts treats one species in *Stereum*.

In the original publication of *C. alutarium* three specimens were listed. Of these the third, Michener's Pennsylvania collection (Curtis *6349*) is the present species; the second, from Sprague (Curtis *5335*) is *Peniophora filamentosa* (Berk. & Curt.) Burt; the first (Curtis *5169*) is not in the Curtis herbarium — at least, not in its proper place. Furthermore, it seems likely that the number is a mistake, or that a third specimen did not exist: in Curtis's lists of fungi sent to Berkeley, *5169* was assigned to an indeterminate *Agaricus*. Whatever may have been the case, Burt (l. c.) designated the Michener collection as the type, and it should be so treated.

CORTICIUM INVOLUCRUM Burt = **Sebacina deminuta** Bourd.

Sebacina (Bourdotia) deminuta Bourd., Assoc. Franç. Avanc. Sci. **45:** 575. 1922; Rogers, Univ. Iowa Studies Nat. Hist. **15**(3): 13. 1933; **17:** 41. 1935; McGuire, Lloydia **4:** 39. 1941.

Corticium involucrum Burt, Missouri Bot. Gard. Ann. **13**: 271. 1926 (!!).
Bourdotia deminuta (Bourd.) Bourd. & Galz., Hymén. de France p. 50. [1928].

As has already been pointed out by Rogers, and by McGuire, *Corticium involucrum* Burt may be eliminated from the list of North American species of *Corticium*.

CORTICIUM JAMAICENSE Burt = **Vararia Peniophoroides** (Burt) comb. nov.

Hypochnus Peniophoroides Burt, Missouri Bot. Gard. Ann. **3**: 234. 1916 (!!).
Corticium jamaicense Burt, Missouri Bot. Gard. Ann. **13**: 273. 1926 (!!).
Vararia Peniophoroides (Burt) comb. nov.

Burt's species, both of which are based on collections made in Jamaica, are characterized by compact buffy fructifications, abundant loosely branched yellow dichophyses, large fusiform gloeocystidia, and subglobose spores which are yellowish, thick-walled, marked by a prominent apiculus on the flattened side, and ornamented by blunt hemispherical or short ridge-like warts. In *H. Peniophoroides* (represented by quite old material) the contents of the gloeocystidia have formed a hyaline, refractive, vitreous body, cracked, and conforming roughly to the gloeocystidium. In *C. jamaicense* (represented by excellent specimens) the concretion is brown and less dense. There are no other differences; and there is no great doubt that the two names apply to the same fungus. There is no indication on Burt's specimens of the color of the fresh spores; but those of the closely related *V. effuscata* are rosy in mass when fresh, and fade as those of the present species may well have done.

Asterostromella rhodospora Wakef. (Kew Bul. Misc. Inf. **1915**: 372. 1915.), to judge from the description and figures, may well be the same species. The spore measurements published are the same as those given for Burt's species. Actually the spores in the American collections are larger, running about 7.5–10 x 7–9 μ. This difference is not in itself significant but since it is not feasible to ask for a loan of the type under present conditions, it seems best not to base a new combination for this fungus on Miss Wakefield's species.

The Langlois collection cited by Burt as *H. Peniophoroides* is not that species. Donk (Nederl. Myc. Ver. Med. **22**: 35. 1933.) cites *H. Peniophoroides* as a synonym of *Hypochnus pallescens* (q. v.) but it is distinct.

CORTICIUM KOLEROGA (Cooke) Höhn. = **Pellicularia Koleroga** Cooke

Corticium Koleroga (Cooke) Höhn.; Burt, Missouri Bot. Gard. Ann. **5**: 123. 1918; **13**: 292. 1926; Wolf & Bach, Phytopath. **17**: 705. 1927.
Pellicularia Koleroga Cooke; Rogers, Farlowia **1**: 112. 1943, ubi synon.

CORTICIUM LACTEUM Fries Nomen dubium.

In the Burt herbarium, now at the Farlow Herbarium, there are nineteen American collections referred to *C. lacteum* Fries. These have all been carefully examined. Twelve of them are *Corticium radiosum* Fries. Gloeocystidia and the characteristic spores of that species have been demonstrated in each. It is noticeable that most of the collections referred

to above, which prove to be *C. radiosum*, are rather old and in poor condition. The failure of Burt to observe the gloeocystidia, which are uniformly present, may perhaps be explained by his insistence on the examination of sectioned preparations. The gloeocystidia are readily demonstrated in properly prepared crushed mounts. Two collections prove to be *Peniophora albula* Atk. & Burt (q. v.). The remaining five have not been identified but appear to be all different from each other and none of them agrees at all closely with either *C. radiosum* or the type of *C. lacteum* as designated by Burt (Missouri Bot. Gard. Ann. **13:** 212. 1926.). In the herbarium of the Missouri Botanical Garden there are eighteen of the collections cited by Burt as *C. lacteum*. Eight of these are *C. radiosum* and seven have not been identified, including two which are in very poor condition but may be *C. radiosum*. Three of the Canadian collections made by J. Macoun are as follows: *165* is, in part, *C. punctulatum* Cooke; *286* is *C. albocremeum* Höhn. & Litsch.; and *349* is *C. vellereum* Ellis & Cr.

Litschauer (Österr. Bot. Zeitschr. **88:** 109. 1939.), after having examined collections in the Romell herbarium which had been determined by Burt, has concluded that *C. lacteum* Fries *sensu* Burt is "*Gloeocystidium alutaceum* (Schrad.) Bourd. & Galz. (= *C. radiosum* Fries)." In the Burt herbarium there are five collections from the Romell herbarium (only three of which are cited); all of these are *C. radiosum*. With this evidence we can not do other than concur in Litschauer's conclusion.

Having disposed of *C. lacteum sensu* Burt, we may now consider other concepts. *C. lacteum sensu* Bourdot & Galzin and of Litschauer is quite a different fungus, better known under the name *Corticium tuberculatum* Karst. *Corticium lacteum sensu* Fuckel (Symb. Mycol. **2** Nachtr.: 8. 1873.) should be the same as *Peniophora candida* Lyman (Science n. s. **25:** 290. 1907.). The proper interpretation of *C. lacteum* (Fries) Fries, (Epicr. Syst. Mycol. p. 560. 1838.) is quite another matter. It is based on *Thelephora lactea* Fries (Syst. Myc. **1:** 452. 1821.), which Fries described only in the vaguest terms. A fragment of a specimen in the Fries herbarium, determined by Fries as *T. lactea*, was sent to Burt by Romell. It was this specimen which Burt designated as the type and which was to represent his intended concept. As noted above, his actual concept proves to be *C. radiosum*. This specimen has been studied and compared with the type of *Thelephora bombycina* Sommerf. (Fl. Lapp. Suppl. p. 284. 1826; = *Corticium bombycinum* (Sommerf.) Karst., Hedwigia **32:** 120. 1893.). The two are the same fungus. Other and later specimens, assigned by Fries to *C. lacteum*, represent other species; in particular the authentic specimen at Kew which Burt discusses is quite different, having more slender hyphae without clamps. It is probable that *Thelephora lactea* and the names based on it were no more than designations for various soft creamy corticioid fungi; it is, therefore, here proposed that they be in consequence rejected, as *nomina dubia*, under Art. 63 of the Rules.

The alternative is quite clear. Unless there is evidence that some other specimen of Fries's under *Thelephora lactea* is the actual specimen from which he drew up his description, the specimen designated by Burt as the type becomes the type, and the name *Corticium lacteum*, concerning which there has been so much confusion, replaces the better known *C. bombycinum* which has never been in doubt. It appears more likely that mere chance determined that *Thelephora lactea* should come into conflict with *T. bombycina* than that Fries ever had a sharply defined concept of the former. Frequently it is advantageous to attribute to Fries greater taxonomic acumen than he may have possessed; here it seems more desirable to recognize confusion, and to reject its results.

CORTICIUM LAETUM (Karst.) Bres., sensu Burt

An examination of all the American collections cited by Burt (Missouri Bot. Gard. Ann. **13**: 223. 1926.) as this species reveals that the Michigan collection is *Peniophora aurantiaca* (Bres.) Höhn. & Litsch., the one from New York is *Corticium confluens* Fries and the North Dakota collection cannot be named but is neither of the above nor *C. laetum*. No American collections have come to light which can be properly referred to this characteristic species. The name should, therefore, be dropped for the present as a component of the North American flora.

CORTICIUM OCHROFARCTUM Burt = **C. pallidum** Bres.

Corticium pallidum Bres., Fungi Trident. **2**: 59. 1898 (!).
Gloeocystidium pallidum (Bres.) Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsber. **116**, I: 838. 1907; Bourd. & Galz., Hymén. de France p. 258. [1928].
Gloeocystidium argillaceum sensu Höhn. & Litsch., Wiesner-Festschr. p. 67. 1908; nec *Corticium argillaceum* Bres., Fungi Trident. **2**: 63. 1898.
Gloeocystidium pallidum subsp. *argillaceum* sensu Bourd. & Galz., Soc. Mycol. Fr. Bul. **28**: 363. [1913]; Hymén. de France p. 258. [1928], quantum ad specim.
Corticium ochrofarctum Burt, Missouri Bot. Gard. Ann. **13**: 275. 1926 (!!).

The type of *Corticium ochrofarctum* is in poor condition, but superficially and in all observable microscopic characters exactly equals the only paratype (Weir *11122*) collected the same day and place, which is good *Corticium pallidum*. Both collections are from Idaho. This species has been found to be very common in Ontario as shown by about fifteen collections so assigned in the herbarium of the University of Toronto. It is also known from Massachusetts and Oregon and doubtless has a wide distribution in North America. *Corticium Tsugae* Burt, which is also common in Ontario, is closely related. The spores are, however, consistently shorter than in *C. pallidum*.

CORTICIUM OVERHOLTSII Burt = **Peniophora duplex** Burt

Peniophora duplex Burt, Missouri Bot. Gard. Ann. **12**: 298. [1926] (Feb.) (!!).
Corticium Overholtsii Burt, Missouri Bot. Gard. Ann. **13**: 245. 1926 (Sept.) (!!); Overh., Mycologia **21**: 281. 1929.

The type of *C. Overholtsii* consists of a young hymenium, just beginning to sporulate, growing over the surface of an old fructification, probably of the same fungus. The species was described as possessing neither gloeocystidia nor cystidia. Gloeocystidia are, however, abundant in the type. While no cystidia were demonstrated in the type collection, all other structures correspond with those of *Peniophora duplex*. *C. Overholtsii* may best be interpreted as a young growth in which the cystidia have not yet fully developed.

P. duplex, in its essential structures, is so much like *Stereum Pini* (Schleich. ex Fries) Fries as to suggest a close relationship. The differences are mainly in color of the younger fructifications and in color and consistency of the older ones. *P. duplex* at full maturity does not resemble at all closely the brown, cracked fructifications characteristic of *S. Pini* as it occurs on *Pinus Strobus* in America or on *Pinus sylvestris* in Europe. It is possible that further study, involving cultures, may show that *P. duplex* is best interpreted as a growth phase or variety of *S. Pini*. For the present, however, it seems advisable to retain it as a separate species and leave it in *Peniophora* where it is most likely to be sought.

CORTICIUM PACTOLINUM Cooke & Hark. Excluded.

Corticium pactolinum Cooke & Hark., Grevillea **9**: 81. 1881 (!).
Chromosporium pactolinum (Cooke & Hark.) Cooke, Grevillea **16**: 72. 1888.

C. pactolinum is not accounted for in Burt's Thelephoraceae, presumably because he accepted Cooke's conclusion that the species was a *Chromosporium*.

The Harkness material at hand consists of a thick, compact, cracked layer of ochre-colored spores, with heavy walls and with the oblique apiculus of a basidiospore. According to information supplied by Lee Bonar, the "fructification" on which this species was based consists of a heavy deposit of the basidiospores of *Inonotus Leei* Murr.; and certainly the spores compare favorably with those of the related *I. hispidus* Karst. Ellis and Everhart (Jour. Mycol. **6**: 79. 1890) ascribe this and two other species of *Chromosporium* to *Mucronoporus Andersoni* Ellis & Everh. There is here no necessity to pass upon the specific distinctness of *I. Leei* or *M. Andersoni*. It seems clear that *C. pactolinum* was described from the spore fall of a polypore (*Inonotus* Karst., *Xanthochrous* Pat.) and has no place in the Thelephoraceae.

CORTICIUM PARAPHYSATUM Burt = **Aleurodiscus paraphysatus** (Burt) comb. nov.

Corticium paraphysatum Burt, Missouri Bot. Gard. Ann. **13**: 177. 1926 (!!).
Aleurodiscus paraphysatus (Burt) comb. nov.

This species is based on a collection from Cuba. Three paratypes are listed, all from the same region, and, like the type, all collected by C. J. Humphrey. The type specimen shows, scattered through the hymenium, subglobose bodies, filled with brown resinous material, some appearing isolated, some stalked; the trama consists in large part of delicate tubules

of mineral, contorted, about 1 μ in diameter, from which all sign of an enclosed hypha has disappeared. A recent collection made by W. Lawrence White in Cuba is certainly the same fungus, is in much better condition, and shows the same tubules as well as numerous stout capitate-cylindric cystidia which at first are colorless but ultimately develop a brown content which presumably is what is preserved in the weathered or disintegrating spheres of the type. Spores are numerous, hyaline, even-walled, clavate, obliquely long-attenuate to the base, 14–18 x 7–7.5 μ. Corresponding bodies occur in the type, scarcely recognizable as spores since the few that are present have absorbed color from the resin-bearing structures. A few mature basidia are present in the recent collection and are clearly the stocky, truncate-cylindric sort found in many species of *Aleurodiscus*. The species should be readily recognizable from the spores, cystidia, and tubules.

CORTICIUM PECTINATUM Burt = **Vararia pectinata** (Burt) comb. nov.

Corticium pectinatum Burt, Missouri Bot. Gard. Ann. **13**: 286. 1926 (!!).
Vararia pectinata (Burt) comb. nov.

Superficially and structurally this species closely resembles Burt's *C. racemosum* (q. v.). The basidia, ventricose-clavate, long-emergent, with fragile sterigmata, are much larger in *C. pectinatum*. The dichophyses are the most delicate and obscure encountered, with branches under 0.5 μ; and without the confirmation of the basidial type the position of the species would be doubtful. Gloeocystidia are abundant and conspicuous in the type. The spores, which are difficult to find, are, however, not infrequent in some preparations. They are fusoid-clavate, strongly tapered and sharply geniculate below the middle, 11–16.5 x 4–4.5 μ.

CORTICIUM PEZIZOIDEUM Ellis & Everh.

Ellis & Everhart's species was omitted from Burt's account of the genus. See under *Corticium centrifugum* (Lév.) Bres.

CORTICIUM PILOSUM Burt = **Peniophora subalba** (Burt) comb. nov.

Corticium pilosum Burt, Missouri Bot. Gard. Ann. **13**: 262. 1926 (!!); nec *Peniophora pilosa* Burt, Missouri Bot. Gard. Ann. **12**: 291. [1926].
Corticium subalbum Burt, Missouri Bot. Gard. Ann. **13**: 267. 1926 (!!).
Peniophora subalba (Burt) comb. nov.

The types of both species are on *Alnus* from adjoining Southern states. They are identical in gross appearance and in microscopic detail. The appearance of slender paraphyses noted in the original descriptions seems to be due to collapsed basidia and not to any special structure. The difference in spore size recorded in the descriptions is not borne out by an examination of the types. There are cylindrical spores, slightly flattened on one side, with lateral apiculus, measuring 10–13 x 4.5–5 μ, in both type collections.

The species is a gloeocystidiate *Peniophora* related to *Peniophora incarnata* (Pers.) Karst. and *Peniophora aurantiaca* (Bres.) Höhn & Litsch.,

and intermediate between the two in the character of the spore. The cystidia are of the type characteristic of the two species mentioned above but are very scarce and easily overlooked. They have, however, been demonstrated in the types of both the species described by Burt.

All of the seven paratypes cited by Burt as *C. pilosum* have been examined. Not one is like the type. The single paratype from Georgia listed under *C. subalbum* is an immature *Aleurodiscus*, probably *A. botryosus* Burt.

CORTICIUM PRUNI Overh. = **C. porosum** Berk. & Curt.

See under *C. stramineum* Bres.

CORTICIUM RACEMOSUM Burt = **Vararia racemosa** (Burt) comb. nov.

Corticium racemosum Burt, Missouri Bot. Gard. Ann. **13:** 287. 1926 (!!).
Vararia racemosa (Burt) comb. nov.

The dichophyses ("antler-shaped" paraphyses) by which Burt determined the kinship of this fungus to *Corticium investiens* (Schw.) Bres. are obscure and very short-branched, but present. What confirms the assignment of the species to *Vararia* is the form of the basidia — something like those of *Aleurodiscus*, something like those of the *Urnigera* group, but exactly like nothing but those of other *Vararia* species. They arise at some depth within the trama, in clusters, as irregular to long-ellipsoid bodies, and continue by a very slender apical prolongation far beyond the general level of the hymenium; at the truncate summit are borne four long, straight, nearly erect sterigmata. The species is distinguishable from others of the genus by the abundant thin-walled fusiform gloeocystidia and the ellipsoid spores.

CORTICIUM ROSEOPALLENS Burt = **C. incrustans** Höhn. & Litsch.

Corticium incrustans Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **115,** I: 1602. 1906 (!!); Rogers, Univ. Iowa Studies Nat. Hist. **17:** 27. 1935.

Corticium roseo-pallens Burt apud Lyman, Boston Soc. Nat. Hist. Proc. **33:** 173. 1907 (? !!); Burt, Missouri Bot. Gard. Ann. **13:** 240. 1926; Bourd & Galz., Hymén. de France p. 215. [1928].

Rogers (l. c.) has already pointed out the identity of the species listed above. It is not certain that the Vermont specimen designated as the type by Burt in 1926 is actually the type (i. e., the basis of the 1907 description in Lyman); but there seems no reason to doubt that it correctly represents the species.

CORTICIUM ROSEUM (Pers. ex Fries) Fries = **Aleurodiscus roseus** (Pers. ex Fries) Höhn. & Litsch.

Thelephora rosea Pers. ex Fries, Syst. Mycol. **1:** 451. 1821.

Corticium roseum (Pers. ex Fries) Fries, Epicr. Syst. Mycol. p. 560. 1838; Burt, Missouri Bot. Gard. Ann. **13:** 224. 1926; Bourd. & Galz., Hymén. de France p. 227. [1928].

Lyomyces roseus (Pers. ex Fries) Karst., Bidr. Känned. Finl. Nat. Folk **37**: 153. 1882.

Hypochnus roseus (Pers. ex Fries) Schroet. in Cohn, Krypt.-Fl. Schles. **3**(1): 417. 1888.

Peniophora rosea (Pers. ex Fries) Massee, Linn. Soc. Bot. Jour. **25**: 146. 1889.

Aleurodiscus roseus (Pers. ex Fries) Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **115**: I: 1568. 1906; Pilát, Ann. Mycol. **24**: 219. 1926, ubi synon.

Corticium roseum and its relatives form a small group of species having large *Aleurodiscus*-like basidia and characteristic branched paraphyses in the hymenium. Because the paraphyses are not of the usual type found in *Aleurodiscus* some recent authors, including Burt, have preferred to leave these species in *Corticium*. The species are, however, as shown by the character of the basidia, more properly classified in *Aleurodiscus* where they form a sharply circumscribed group. Pilát (l. c.) has placed them in the subgenus *Lyomyces*. Two species are recognized in Europe, the present one and *A. polygonioides* (Karst.) Pilát. Burt (l. c.) includes the latter as a synonym of *C. roseum*, a disposition which seems extremely doubtful.

CORTICIUM RUBELLUM Burt = **C. confluens** Fries

See under *Coniophora avellanea* Burt.

CORTICIUM SEPTENTRIONALE Burt = **C. Litschaueri** Burt

Corticium Litschaueri Burt, Missouri Bot. Gard. Ann. **13**: 259. 1926 (!!).

Corticium septentrionale Burt, Missouri Bot. Gard. Ann. **13**: 257. 1926 (!!).

A comparison of the types of the two species described by Burt leaves no doubt as to their identity. Since there is no provision in the International Rules which makes page priority compulsory we have chosen to retain the name *C. Litschaueri* rather than *C. septentrionale*, for two reasons: the type collection of the former species is in much better condition than that of the latter; then, too, it seems fitting to conserve the specific name which honors the late Professor Victor Litschauer, eminent among the recent European students of the group, and one to whom both authors of the present contribution are deeply indebted for assistance and authentic materials.

CORTICIUM SOCIATUM Burt = **Aleurodiscus amylaceus** (Bourd. & Galz.)

See under *Corticium ermineum* Burt.

CORTICIUM STEVENSII Burt = **Pellicularia Koleroga** Cooke

Corticium Stevensii Burt, Missouri Bot. Gard. Ann. **5**: 125. 1918; **13**: 293. 1926.

Pellicularia Koleroga Cooke; Rogers, Farlowia **1**: 112. 1943.

CORTICIUM STRAMINEUM Bres. = **C. porosum** Berk. & Curt.

Corticium porosum Berk. & Curt. apud Berk. & Br., Ann. Mag. Nat. Hist. Ser. 5, **3**: 211. 1879; Massee, Linn. Soc. Bot. Jour. **27**: 121. 1890; Wakef., Br. Mycol. Soc. Trans. **4**: 341–342. [1914].

Corticium stramineum Bres. apud Brinkm., Hedwigia **39**: (221). 1900 (!!); Brinkm., Westf. Pilze *18*. 1900; Burt, Missouri Bot. Gard. Ann. **13**: 258. 1926.

Gloeocystidium stramineum (Bres.) Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **116,** I: 765. 1907.
Gloeocystidium contiguum sensu Bourd. & Galz., Hymén. de France p. 255. [1928]; nec *Corticium contiguum* Karst., Soc. Faun. Fl. Fenn. Acta **2**(1): 39. 1881 (!!).
Gloeocystidium porosum (Berk. & Curt.) Wakef. ex Bourd. & Galz., Hymén. de France p. 253. [1928].
Corticium vesiculosum Burt, Missouri Bot. Gard. Ann. **13:** 266. 1926 (!!).
Corticium Pruni Overh., Mycologia **21:** 282. 1929 (!!).
Gloeocystidiellum porosum (Berk. & Curt.) Donk, Nederl. Mycol. Ver. Med. **18–20:** 156. 1931.

The validity of the use of the name *Corticium porosum* for this species has been questioned by Burt (in litt. to Farlow) because of uncertainty with reference to the type collection, and he has used Bresadola's name, *C. stramineum*. *C. porosum* was described in a paper by Berkeley and Broome dealing with "British Fungi." It was, however, credited to "Berkeley and Curtis," presumably because Curtis had sent a collection from Venezuela which Berkeley considered to be the same as a British collection from Aboyne. It is clear from the original account, however, that the British collection was the intended type since, following the Latin description, the first sentence of the comment reads as follows: "Aboyne. Apparently the same with specimens from Venezuela." When Miss Wakefield looked into the situation she found two collections in the Berkeley herbarium, one from Venezuela bearing the number *203*, the other from Glamis (Forfarshire?). No collection from Aboyne could be found. The Glamis collection, however, answers reasonably well to the original description while the Venezuela collection does not and she concludes that " . . . it seems justifiable to regard the Glamis specimen as authentic, even if it is not the actual type . . ." In the meantime Massee had commented on this species and cites collections from Venezuela and Aboyne with no mention of a collection from Glamis. He writes: "Type in Herb. Berk. n.*4034*," without making it clear whether or not this number refers to the Aboyne collection. It would seem evident that a collection from Aboyne was present in the Berkeley herbarium in 1890 and, unless there is more evidence than is given by Miss Wakefield that the Aboyne and Glamis collections are one and the same, this might seem to cast doubt on the authenticity of the Glamis collection. Two courses seem open: either the name *Corticium porosum* should be considered for the present a *nomen dubium* or Miss Wakefield's interpretation accepted and the Glamis collection in the Berkeley herbarium be accepted as authentic.

Since, however, 1) it is obvious that Berkeley intended the name *Corticium porosum* to apply to a British collection, and 2) there is now in the Berkeley herbarium a specimen which answers well to his description even though it may not be the original type, it seems desirable for the present to concur in Miss Wakefield's interpretation and accept the Glamis collection as authentic. It is admittedly quite possible that a different viewpoint might be found necessary in case the Aboyne collection should later be disinterred.

The spores of this species are not only amyloid but also minutely roughened. The latter character seems not to have been previously noted. All collections which we have seen, however, show minute roughening of the spore wall when mounted in water and examined under an oil immersion lens. When KOH is used in the mounting fluid, however, the roughening may not be evident or may gradually disappear. Different collections vary in the degree of roughening of the spores. Those with evident roughening have been commonly referred to *Gl. contiguum* sensu Bourd. & Galz. Four collections from the Bourdot herbarium have been examined. The spore walls in each show definite roughening but there seems to be no essential difference between these collections and those of *C. porosum*. Four collections also of *C. contiguum* from the Karsten herbarium have been examined. Only one of these, and that not the type, is at all comparable to the concept of Bourdot & Galzin. Two of them, including the type, are *Corticium crustaceum* Karst. (q. v.). The fourth is *Gloeocystidium Karstenii* Bourd. & Galz. It seems evident that Bourdot & Galzin's concept was not based on the type collection.

Corticium porosum is designated by Donk as the type of *Gloeocystidiellum* Donk, published as a name for *Gloeocystidium sensu* Höhn. & Litsch. (Weisner-Festschr. p. 58. 1908.), *nec Gloeocystidium* Karst. (Bidr. Känned. Finl. Nat. Folk **48:** 429. 1889.).

Bourdot & Galzin included *Gloeocystidium clavuligerum* Höhn. & Litsch. as a synonym of *Gl. contiguum*. An examination of the three collections in the von Höhnel herbarium reveals that one is typical *C. porosum;* one is *Gl. furfuraceum* Höhn. & Litsch. and the type is not sufficiently like either to justify including it as a synonym.

Corticium vesiculosum Burt is a form with somewhat shorter and broader gloeocystidia than usual and with spores having evidently roughened walls, though this latter feature was not noted by Burt. It matches perfectly collections referred to *Gl. contiguum* by Bourdot. *Corticium Pruni* Overh. is a form with somewhat more abundant subiculum than usual and with spores that appear smooth unless closely examined. There is considerable variation in the character of the gloeocystidia in *C. porosum* and the differences noted by Overholts do not seem significant when a large series of specimens are compared.

CORTICIUM SUBALBUM Burt = **Peniophora subalba** (Burt)

See under *Corticium pilosum* Burt.

CORTICIUM SUBCINEREUM Burt = **C. contiguum** Karst.

See under *Corticium crustaceum* Karst.

CORTICIUM SUBCORONATUM Höhn. & Litsch. = **Pellicularia subcoronata** (Höhn. & Litsch.) Rogers

Corticium subcoronatum Höhn. & Litsch.; Overh., Mycologia **26:** 510. fig. 11. 1934. **Pellicularia subcoronata** (Höhn. & Litsch.) Rogers, Farlowia **1:** 104. 1943, ubi synon.

CORTICIUM SUBGIGANTEUM Berk. = **Aleurodiscus subgiganteus** (Berk.) Höhn.

Corticium subgiganteum Berk., Grevillea **2:** 3. 1873; Burt, Missouri Bot. Gard. Ann. **13:** 215. 1926, ubi synon.
Aleurodiscus subgiganteus (Berk.) Höhn., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **121,** I: 342. 1912.

This species was left in *Corticium* by Burt, presumably because of the lack of any distinctive type of paraphysis. The character of the basidium, however, should be the primary determining factor in deciding the generic position of this species. *C. subgiganteum* appears to be a true *Aleurodiscus.*

The name *Michenera artocreas* Berk. & Curt., which Burt includes in the synonymy of this species, is properly based on its imperfect stage; so is *Artocreas Micheneri* Berk. & Curt. For a note on the vicissitudes of these names, see Martin, Wash. Acad. Sci. Jour. **30:** 378. 1940. *Aleurodiscus Micheneri* (Berk. & Curt.) Massee, Linn. Soc. Bot. Jour. **25:** 120. 1889, is both by typification and by description applicable only to the imperfect stage of *A. subgiganteus.*

CORTICIUM SUBINCARNATUM Peck = **Peniophora subincarnata** (Peck) Litsch.

Corticium subincarnatum Peck, New York State Mus. Rept. **42:** 124. 1889 (!!); nec *Corticium subsulphureum* Karst., Soc. Faun. Fl. Fenn. Med. **6:** 12. 1881.
Peniophora subincarnata (Peck) Litsch., Österr. Bot. Zeitschr. **88:** 117. 1939.

Burt (Missouri Bot. Gard. Ann. **12:** 329. [1926].), included *Corticium subincarnatum* as a synonym of *Peniophora subsulphurea* (Karst.) Höhn. & Litsch. Litschauer has pointed out the differences between the two species. All the American collections cited by Burt prove to be *P. subincarnata* with the exception of that from Idaho (Weir *14*), which is typical *P. subsulphurea.* A second American collection of the latter species made at Priest River, Idaho, by Weir on *Larix occidentalis*, and determined by Bresadola, is in the herbarium of the Bureau of Plant Industry. Both species, then, occur in North America. Burt's description, however, as pointed out by Litschauer, is obviously drawn from collections properly referred to *P. subincarnata.*

The two species are quite similar in general appearance and both occur also in Europe. Litschauer calls attention to certain color differences which, however, are not evident in old dried specimens. The chief difference discernible in the dried material is in the shape and size of the spores. In *P. subincarnata* the spores are ellipsoid, 3.5–5 x 2–2.5μ. In *P. subsulphurea* the spores are cylindrical 6–8 x 1.5–2.5 μ. Four collections made by Karsten have been seen. The one cited by Burt is on *Pinus sylvestris* and the fungus is *P. subsulphurea.* A collection distributed as *Xerocarpus subsulphureus* Karst., in Roumeg. F. Sel. Exsicc. *4307* on *Pinus sylvestris* and another distributed under the same name in Rabenh.-Wint. Fungi Europ. *2723* on *Abies* are both *P. subsulphurea.* A Karsten collection on *Abies* in the von Höhnel herbarium is, however, *P. subincarnata.* It is evident then, that both species occur in Finland. Kar-

sten's original description cites the substratum as "ligno vetusto pineo." While the type of Karsten's species has not been seen, it seems reasonable, from the above evidence, to accept the current concept of Litschauer and of Bourdot and refer to *P. subsulphurea* the collections with the longer cylindrical spore. Specimens from the herbaria of both these authorities have been examined and are consistently the same.

CORTICIUM SULPHUREUM sensu Burt = **C. bicolor** Peck

Ozonium croceum [Kunze] Pers., Mycol. Eur. **1**: 86. 1822.
Athelia citrina Pers., Mycol. Eur. **1**: 86. 1822; nec *Corticium citrinum* (Pers.) Fries, Hymen. Eur. p. 655. 1874 (= *Thelephora citrina* Pers., Mycol. Eur. **1**: 136. 1822.).
Alytosporium croceum ([Kunze] ex Pers.) Link in Linn., Sp. Pl. ed. 4 (Willd.) **6**(1): 24. 1824.
? *Sporotrichum flavissimum* Link. in Linn., Sp. Pl. ed. 4 (Willd.) **6**(1): 9. 1824.
Sporotrichum croceum ([Kunze] ex Pers.) Wallr., Fl. Crypt. Germ. **2**: 279. 1833.
Corticium bicolor Peck, Buffalo Soc. Nat. Hist. Bul. **1**: 62. 1873 (!!); Burt, Missouri Bot. Gard. Ann. **13**: 291. 1926.
Lyomyces byssinus Karst., Soc. Faun. Fl. Fenn. Med. **11**: 137. 1884 (!!).
Tomentella byssina (Karst.) Karst., Bidr. Känned. Finl. Nat. Folk **48**: 420. 1889.
Corticium byssinum (Karst.) Massee, Linn. Soc. Bot. Jour. **27**: 133. 1890; Bourd. & Galz., Hymén. de France p. 200. [1928].
Corticium croceum ([Kunze] ex Pers.) Bres., I. R. Accad. Agiati Atti III **3**: 112. 1897; Bourd. & Galz., Hymén. de France p. 201. [1928]; nec *C. croceum* (Pat.) Sacc., Syll. Fung. **11**: 124. 1895 (= *Aleurodiscus croceus* Pat., Soc. Mycol. Fr. Bul. **9**: 133. 1893.).
? *Corticium byssinum* var. *microsporum* Bres., Ann. Mycol. **1**: 96. 1903; Litsch., Bot. Inst. Techn. Hochsch. Wien Mitt. **4**: 90. 1927.
Corticium flavissimum sensu Bres. apud Bourd. & Galz., Soc. Mycol. Fr. Bul. **27**: 242. 1911; Hymén. de France p. 200. [1928]; an *Sporotrichum flavissimum* Link ?
Spicaria croceum ([Kunze] ex Pers.) Oudem., Enum. Syst. Fung. **1**: 281. 1919.
Corticium sulphureum sensu Burt, Missouri Bot. Gard. Ann. **13**: 177. 1926; an Fries, Hymen. Eur. p. 650. 1874, pro parte ?; nec *Thelephora sulphurea* Pers. ex Fries.
Corticium byssinum var. plur. Bourd. & Galz., Hymén. de France p. 200. [1928].
(*Himantia sulphurea* Pers., Roem. Neu. Mag. Bot. p. 122. 1794; nec *C. sulphureum* Pers.; nec *Thelephora sulphurea* (Pers.) Pers.
(? *Sporotrichum flavissimum* Link, Ges. Naturf. Fr. Berl. Mag. **7**: 34. 1816.
(*Sporotrichum croceum* Kunze, Mykol. Hefte **1**: 81. 1817.
(*Athelia citrina* Pers., Traité sur les Champ. p. 67. 1819.

There must be considerable uncertainty concerning the early synonymy of such ubiquitous fungi as those treated in Burt under the names *Corticium sulphureum* and *Hypochnus fumosus;* and the present rather full treatment is given only because most of the names listed enter into the problem of the nomenclature of these two fungi. There seems to be no disagreement among the various mycologists who have treated *H. fumosus sensu* Burt (q. v.) that it is actually *C. sulphureum* Pers. The chief question is whether *Thelephora sulphurea* Pers. ex Fries is the same fungus as Persoon's *Corticium.* Leaving aside the problem whether Persoon's or Fries's fungus determines the application of the name, one may well at-

tempt to discover whether there was ever any divergence between the concepts of those two authors. To judge from Fries's treatment in the "Hymenomycetes Europaei," there was in 1874. Burt supported his assertion that Fries's concept was other than Persoon's by his account of a single specimen of *C. sulphureum* from Fries at Kew which, he wrote, is the same as his (Burt's) concept of the species. Burt's slide is preserved; it shows no spores; but the subhymenial hyphae are distinct enough, and are often quite wide, often abruptly swollen at the septa, and clearly nodose-septate. The Friesian specimen cannot, then, be *C. sulphureum* sensu Burt, which has slender, uniform hyphae without clamps; it may well be *C. sulphureum* Pers. which has such mycelium as here described.

Corticium byssinum and its varieties, *C. bicolor*, and probably *C. flavissimum*, have no significant differences beyond color, extremely variable here, as attested by Bourdot & Galzin's varieties of *C. byssinum*. Unless *S. flavissimum* can be better established than it is at present, *C. bicolor* is the oldest name.

Burt cites Warrensburg, N. Y., as the type locality for *C. bicolor*. In the original description, however, Center (now Karner) New York, is given as the place of collection. In the herbarium of the New York State Museum there is a sheet of mounted specimens which is marked "type." On this sheet beside each piece is marked either the number "1" or "2". On the label the information is furnished that "1" refers to collections made at Center and "2" to collections made at Warrensburg. It is evident that Burt overlooked this point. Fortunately the two collections are of the same species.

CORTICIUM VAGUM Berk. & Curt. = **Pellicularia vaga** (Berk. & Curt.) Rogers

Corticium vagum Berk. & Curt., Burt, Missouri Bot. Gard. Ann. **5**: 128. 1918; **13**: 295. 1926.

Pellicularia vaga (Berk. & Curt.) Rogers ex Linder; Rogers, Farlowia **1**: 110. 1943, ubi synon.

CORTICIUM VAGUM var. SOLANI Burt = **Pellicularia filamentosa** (Pat.) Rogers

Corticium vagum var. *Solani* Burt ex Rolfs, Science n. s. **18**: 729. 1903; Missouri Bot. Gard. Ann. **13**: 295. 1926.

Pellicularia filamentosa (Pat.) Rogers, Farlowia **1**: 113. 1943, ubi synon.

CORTICIUM VESICULOSUM Burt = **C. porosum** Berk. & Curt.

See under *Corticium stramineum* Bres.

CORTICIUM VINOSOSCABENS Burt = **Corticium Macounii** Burt

Corticium Macounii Burt, Missouri Bot. Gard. Ann. **13**: 256. 1926 (!!).

Corticium vinososcabens Burt, Missouri Bot. Gard. Ann. **13**: 267. 1926 (!!).

Corticium maculatum Litsch., Österr. Bot. Zeitschr. **77**: 124. 1928 (!!); J. Weese, Eumycetes Sel. Exs. *336* (!).

An examination of the three fungi listed above leads to the conclusion that all are the same. The differences in gross appearance, particularly those brought out in the two descriptions furnished by Burt, disappear when a larger series of collections is available. The type of *C. Macounii*

is on decorticated firm wood with little development of subiculum. That of *C. vinososcabens* is on bark, with relatively abundant development of loose subiculum. Collections are now available in which both conditions are present in the same material. A series of collections of *C. maculatum* received from Litschauer shows the same variation.

There are no essential microscopic differences noticeable in the three types. Careful study of the type and comparable collections of *C. vinososcabens* fails to reveal any structures answering to the "vesicular bodies" mentioned by Burt. There are present hyphal paraphyses approaching gloeocystidia mentioned in the description of *C. Macounii* and figured by Litschauer for *C. maculatum*.

The other collections cited by Burt have been examined. Of the collections assigned to *C. vinososcabens*, the Wisconsin record is correct but the New York record proves to be *Gloeocystidium Karstenii* Bourd. & Galz., a common species in northeastern North America on *Populus*, but not recognized by Burt as such. Those referred to *C. Macounii* include two specimens of *C. confluens* Fries (New Hampshire and New York) and one (Macoun *86*) the same as the type.

GLOEOCYSTIDIUM

GLOEOCYSTIDIUM ALBO-STRAMINEUM (Bres.) Overh. = **Corticium geogenium** Bres.

See under *Peniophora albo-straminea* Bres.

GLOEOTULASNELLA

GLOEOTULASNELLA OPALEA Rogers = **G. traumatica** Bourd. & Galz.

Gloeotulasnella traumatica Bourd. & Galz., Soc. Mycol. Fr. Bul. **25**: 32. 1909 (!!); Hymén. de France p. 64. fig. 43. [1928]; Rogers, Ann. Mycol. **31**: 197. 1933.

Gloeotulasnella opalea Rogers, Ann. Mycol. **31**: 198. 1933 (!!).

Upon comparison of the types, the distinctions upon which *G. opalea* was founded vanish. The hypobasidia of *G. traumatica* are not ovoid, but long-stalked and subglobose; the long spores described for that form are free epibasidia. Additional specimens are at hand from Ontario and Iowa.

HYPOCHNUS

HYPOCHNUS ALBUS Burt = **Aleurodiscus albus** (Burt) comb. nov.

Hypochnus albus Burt, Missouri Bot. Gard. Ann. **13**: 319. 1926.
Aleurodiscus albus (Burt) comb. nov.

The type of Burt's species, while certainly not a *Tomentella*, possesses a combination of characters which make its true relationship difficult to determine. The spores are colorless, non-amyloid, when mature with minutely verrucose wall-markings running about 12 granules to 10 μ (not echinulate as described by Burt). They are obovate, slightly flattened on one side toward the base, 10–13 x 8–9.5 μ and not globose, 7.5 μ

in diameter, as described. The cystidia are prominent, projecting nearly their whole length, 125–200 μ long, 8–10 μ wide at the middle and 10–17 μ at the base, gradually tapering to an acute apex. The walls of the cystidia are thick, longitudinally laminate, with narrow lumen and rugose on the surface. The basidia are cylindric or slightly enlarged below, 24–26 x 8–10 μ, with 4 sterigmata which are at first stout cylindric and slightly divergent, becoming arcuate, 7–10 μ long and 3 μ in diameter at the base. Not much could be made of the structure. A few fine subicular hyphae with clamps are present, 1–2.5 μ in diameter. An abundance of fine particles is present but these seem not to be part of any structure and no evidence could be obtained of the occurrence of "paraphyses delicate, branching in antler-shaped form." There is certainly no structure present which would suggest relationship with *Peniophora phyllophila* Massee (q. v.), with which Burt compares this species.

The cystidia are of a type not to be expected in *Aleurodiscus;* they are such as might be found in *Peniophora* sec. *Tubuliferae* subsect. * * of Bourd. & Galz. But 1) the composition of the fruiting-body, consisting as it does of a few delicate contorted basal hyphae, imbedded in a mass of mineral material, and giving rise near the substratum to scattered basidia, 2) the structure of the basidia, imbedded subglobose bodies giving rise to thick clavate prolongations which work to the surface and bear relatively large sterigmata, and 3) the rough-walled spores are all foreign to any section of *Peniophora,* and typical of *Aleurodiscus.* There scarcely seems to be any limit to the sterile organs that can be associated with aleurodiscoid structure: witness *A. Bertii* Lloyd and *A. aurantius* (Pers.) Schroet. with gloeocystidia, *A. macrosporus* Bres. and *A. subcruentatus* (Berk. & Curt.) Burt with relatively thin-walled cystidia, and *Corticium paraphysatum* Burt (q. v.) with capitate cystidia, not to mention the commoner dendrophyses, acanthophyses, and pseudophyses. In *Aleurodiscus* the cystidia of *A. albus* constitute, from the standpoint of present knowledge of the genus, an innovation: in *Peniophora* the structure would make the species wholly a misfit.

HYPOCHNUS FIBRILLOSUS Burt = **Corticium fibrillosum** (Burt) comb. nov.

Tomentella trigonosperma sensu Höhn. & Litsch., Österr. Bot. Zeitschr. **58**: 334. 1908; Bourd. & Galz., Hymén. de France p. 512. [1928], quantum ad descr. et specim.; nec *Corticium trigonospermum* Bres., Ann. Mycol. **3**: 163. 1905.
Hypochnus fibrillosus Burt, Missouri Bot. Gard. Ann. **3**: 238. 1916 (!!).
Tomentella fibrillosa (Burt) Bourd. & Galz., Hymén. de France p. 513. [1928].
Corticium fibrillosum (Burt) comb. nov.

Since the binomial *Tomentella trigonosperma* is based on *C. trigonospermum* Bres., even though it has come to be applied to quite a different species it must be relegated to synonymy and Burt's specific name taken up. The species is out of place in *Tomentella* and closely related to certain rough-spored species of *Corticium,* hence a new combination is proposed.

Von Höhnel and Litschauer transferred the specific name to *Tomentella* in the belief that Bresadola's *Corticium* and their fungus were the same. They described (l. c., and K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **117,** I: 1090–1091. 1908.) a round-angular stage and a globose-spinulose stage in the development of the spores, placing together what a long series of European and American specimens show to be constant and separate organisms. The error is partially explained by the material in von Höhnel's herbarium. The sheet for *T. trigonospermum* carries five packets: two of *Corticium trigonospermum,* two containing *C. fibrillosum,* and one with a fungus whose spores are smooth and round. Furthermore, intermixed with *C. fibrillosum* in one packet is a large proportion of *Peniophora byssoides* (Pers. ex Fries) Bres., in which the mycelium is strikingly similar but the spores oblong and smooth. Presumably the smooth-spored specimens are the source of the confusion; the rough-spored specimens show no transitional forms.

HYPOCHNUS FILAMENTOSUS Burt = **Corticium sulphureum** (Pers. ex Fries) Fries
See under *Hypochnus fumosus* sensu Burt.

HYPOCHNUS FLAVO-BRUNNEUS Dearn. & Bisby = **Coniophora suffocata** (Peck) Massee
See under *Coniophora Sistotremoides* sensu Burt.

HYPOCHNUS FUMOSUS sensu Burt = **Corticium sulphureum** (Pers. ex Fries) Fries
Phlebia vaga sensu Fries, Hymen. Eur. p. 625. 1874; Bres., I. R. Accad. Agiati Atti III **3:** 105. 1897; an Fries, Syst. Mycol. **1:** 428. 1821 ?; nec *Corticium vagum* Berk. & Curt., Grevillea **1:** 179. 1873.
Thelephora sulphurea Pers. ex Fries, Syst. Mycol. **1:** 452. 1821, sp. Himantiae e synon. excl.; Elenchus Fung. **1:** 204. 1828, excl. synon.
Athelia sericea Pers., Mycol. Eur. **1:** 85. 1822.
? *Thelephora fumosa* [Fries] Pers., Mycol. Eur. **1:** 147. 1822.
Hyphoderma sulphureum (Pers. ex Fries) Wallr., Fl. Crypt. Germ. **2:** 577. 1833.
Hypochnus sericeus (Pers.) Wallr., Fl. Crypt. Germ. **2:** 310. 1833.
Corticium sulphureum (Pers. ex Fries) Fries, Epicr. Syst. Mycol. p. 561. 1838 (falso ut '*sulfureum*'); Bres., I. R. Accad. Agiati Atti III **3:** 111. 1897; Burt, Missouri Bot. Gard. Ann. **13:** 177. 1926, quantum ad typum Persoonianum, descr. & spec. Burt. excl.; Bourd. & Galz., Hymén. de France p. 234. [1928].
? *Corticium fumosum* ([Fries] ex Pers.) Fries, Epicr. Syst. Mycol. p. 562. 1838; Ic. Fung. **2:** 98. pl. 198, fig. 3. 1884.
Odontia fusca Cooke & Ellis, Grevillea **9:** 103. 1881.
Lyomyces sulphureus (Pers. ex Fries) Karst., Soc. Faun. Fl. Fenn. Med. **9:** 54. 1882.
Coniophora sulphurea (Pers. ex Fries) Quél., Ench. Fung. p. 212. 1886; Massee, Linn. Soc. Bot. Jour. **25:** 132. 1889.
? *Tomentella Menieri* Pat., Tab. Anal. 2 ser. p. 32. fig. 580. 1886.
Odontia vaga sensu Karst., Soc. Faun. Fl. Fenn. Med. **14:** 86. 1887; an *Phlebia vaga* Fries ?
? *Thelephora Menieri* (Pat.) Sacc., Syll. Fung. **6:** 547. 1888.
Hypochnus sulphureus (Pers. ex Fries) Schroet. in Cohn, Krypt.-Fl. Schles. **3**(1): 417. 1888.
Tomentella sulphurea (Pers. ex Fries) Karst., Bidr. Känned. Finl. Nat. Folk **48:** 419. 1889.
? *Coniophora fumosa* sensu Massee, Linn. Soc. Bot. Jour. **25:** 139. 1889; nec *C. fumosa* Karst., Soc. Faun. Fl. Fenn. Med. **6:** 13. 1881 (= *C. olivacea* ([Fries] ex Pers.).

Phlebriella vaga sensu Karst., Hedwigia **29**: 271. 1890; an *Phlebia vaga* Fries ?
Odontia tenuis Peck, New York State Mus. Rept. **44**: 134. [1891].
Caldesiella vaga sensu Pat., Essai Taxon. p. 120. 1900; an *Phlebia vaga* Fries ?
Hypochnus vagus sensu Kauffm., New York State Mus. Bul. **179**: 88. 1915; an *Phlebia vaga* Fries ?
Hypochnus fumosus sensu Burt, Missouri Bot. Gard. Ann. **3**: 239. 1916; an *T. fumosa* [Fries] Pers. ?
Hypochnus filamentosus Burt, Missouri Bot. Gard. Ann. **13**: 320. 1926 (!!); nec *H. filamentosus* Pat., Soc. Mycol. Fr. Bul. **7**: 163. 1891.
(*Corticium sulphureum* Pers., Obs. Mycol. **1**: 38. 1796.
(*Thelephora sulphurea* (Pers.) Pers., Syn. Fung. p. 579. 1801; nec *Himantia sulphurea* Pers., Roem. Neu. Mag. Bot. p. 122. 1794 (= *Ozonium croceum* [Kunze] Pers., Mycol. Eur. **1**: 86. 1822.).
(*Hypochnus fumosus* Fries, Obs. Mycol. **2**: 279. 1818.

As noted under *Corticium sulphureum sensu* Burt (q. v.), there has never been any doubt that the present fungus (i. e., Burt's *H. fumosus*) is Persoon's *T. sulphurea;* and whether or not Fries treated only this fungus as *T. sulphurea* (he probably had a variety of things), the one Friesian specimen available for study makes it highly probable that Persoon's fungus was also a part of Fries's assemblage (cf. Massee, l. c.). Of the other names, only *Phlebia vaga* Fries is of equal date; and it is not available for use in the genus *Corticium.* While there is little doubt that *P. vaga* was applied in the "Hymenomycetes Europaei" to the present fungus, the description in the Systema gives no indication of its limits in 1821. The specific name "fumosa" dates from 1822; but its application is even more doubtful. Fries's description and especially his figure of *C. fumosum* seem rather to apply to a *Coniophora;* and Karsten (1881) published a species in that genus which he equated to "*Corticium fumosum* Fries pr. p." *C. sulphureum* seems clearly the proper name for the fungus; if it be for any reason rejected, a name based on *Athelia sericea* must be used.

HYPOCHNUS ISABELLINUS (Fries ex Pers.) Fries = **Pellicularia isabellina** (Fries ex Pers.) Rogers

Hypochnus isabellinus (Fries ex Pers.) Fries; Burt, Missouri Bot. Gard. Ann. **3**: 222. 1916.
Pellicularia isabellina (Fries ex Pers.) Rogers, Farlowia **1**: 99. 1943, ubi synon.

HYPOCHNUS LANGLOISII Pat. = **Pellicularia Langloisii** (Pat.) Rogers

Hypochnus Langloisii Pat., Soc. Mycol. Fr. Bul. **24**: 3. 1908.
Pellicularia Langloisii (Pat.) Rogers, Farlowia **1**: 101. 1943, ubi synon.

The Patouillard species, based on a collection from Louisiana made by Langlois, was omitted from Burt's treatment.

HYPOCHNUS PALLESCENS (Schw.) Burt = **Vararia pallescens** (Schw.) comb. nov.

Thelephora pallescens Schw., Am. Phil. Soc. Trans. n. s. **4**: 167. [1832] (!!).
Thelephora insinuans Schw., Am. Phil. Soc. Trans. n. s. **4**: 167. [1832] (!!).
Corticium Thelephoroides Ellis & Everh., Jour. Mycol. **1**: 88. 1885 (!!).
Corticium sordulentum Cooke & Massee, Grevillea **16**: 69. 1888.
Stereum insinuans (Schw.) Sacc., Syll. Fung. **6**: 586. 1888.
Coniophora sordulenta (Cooke & Massee) Sacc., Syll. Fung. **6**: 650. 1888.

Coniophora insinuans (Schw.) Massee, Linn. Soc. Bot. Jour. **25**: 138. 1889.
Corticium pallescens (Schw.) Massee, Linn. Soc. Bot. Jour. **27**: 129. 1890.
Stereum duriusculum sensu Bres., Ann. Mycol. **6**: 43. 1908; Overh., Mycologia **30**: 279. 1938 (falso ut "*S. duriusculum* Bres."); nec *S. duriusculum* Berk. & Br., Linn. Soc. Bot. Jour. **14**: 66. 1875.
Hypochnus Thelephoroides (Ellis & Everh.) Burt, Missouri Bot. Gard. Ann. **3**: 235. 1916.
Hypochnus pallescens (Schw.) Burt, Missouri Bot. Gard. Ann. **4**: 267. 1917, ubi synon.
Asterostromella dura Bourd. & Galz. apud Bourd. & Maire, Soc. Mycol. Fr. Bul. **36**: 74. 1920; Hymén. de France p. 396. [1928] (!).
Dichostereum durum (Bourd. & Galz.) Pilát, Ann. Mycol. **24**: 223. 1926.
Vararia pallescens (Schw.) comb. nov.

The fructification as ordinarily seen is composed largely of fine dichophyses. The basidia are ventricose-tubular and long-exserted, as in the other members of this genus — never claviform as figured by Bourdot and by Pilát — but their structure is made out only with some difficulty. The spores may be sinuolate or appear almost smooth in KOH; iodine brings out the strongly amyloid roughenings of the spore-wall. *Asterostromella dura* is based on a thick, stratose, probably perennial phase of this species which is occasionally found on partly buried wood or on old roots. It is such a form that Overholts described as "*Stereum duriusculum* Bres."

HYPOCHNUS PENIOPHOROIDES Burt = **Vararia Peniophoroides** (Burt)
See under *Corticium jamaicense* Burt.

HYPOCHNUS POLYPOROIDEUS (Berk. & Curt.) Overh. = **Corticium Polyporoideum** Berk & Curt.
See under *Coniophora Polyporoidea* (Berk. & Curt.) Burt.

HYPOCHNUS THELEPHOROIDES (Ellis & Everh.) Burt = **Vararia pallescens** (Schw.)
See under *Hypochnus pallescens* (Schw.) Burt.

PENIOPHORA

PENIOPHORA ADMIRABILIS Burt Nomen confusum.

P. admirabilis Burt (Missouri Bot. Gard. Ann. **12**: 304. [1926] (!!).) consists of *Tulasnella bifrons* Bourd. & Galz. (Soc. Mycol. Fr. Bul. **39**: 264. [1924].), growing over the surface of overwintered fructifications of one or more thelephoraceous fungi. Burt's description is obviously drawn from sections, and components of the complex substratum of old fungi are included. In so far as they have any objective counterpart, then, the characters of *P. admirabilis* "were derived from two or more entirely discordant elements . . . erroneously supposed to form part of the same individual" (Int. Rules, Art. 64), and the name is not a synonym of either *T. bifrons* or any thelephoraceous form.

PENIOPHORA ALBA Burt = **Peniophora Greschikii** (Bres.) Bourd. & Galz.
Corticium rude Karst., Bidr. Känned. Finl. Nat. Folk. **37**: 143. 1882 (!!); nec *C. rude* Pat., Soc. Mycol. Fr. Bul. **31**: 74. 1915.
Corticium Greschikii Bres., Rev. Mycol. **12**: 109. 1890 (!!).

Gloeocystidium rude (Karst.) Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **115,** I: 1558. 1906.

Peniophora subcremea Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **115,** I: 1600. 1906 (!!); Burt, Missouri Bot. Gard. Ann. **12:** 303. [1926]; Bourd. & Galz., Hymén. de France p. 302 [1928].

Peniophora alba Burt, Missouri Bot. Gard. Ann. **12:** 297. [1926] (!!).

Peniophora rudis (Karst.) Bourd. & Galz., Hymén. de France p. 302. [1928]; Litsch. apud Lund. & Nannf., Fung. Exsicc. Suec. *365.* 1936; nec *P. rudis* (Pat.) Sacc. & Trott., Syll. Fung. **23:** 539. 1925.

Peniophora Greschikii (Bres.) Bourd. & Galz., Hymén. de France p. 300. [1928].

Peniophora subcremea var. *subuncinata* Bourd. & Galz., Hymén. de France p. 302. [1928].

Corticium Greschikii Bres., based on a single collection made by Greschik in Hungary, has evidently been frequently misinterpreted, most recently by Litschauer (Österr. Bot. Zeitschr. **88:** 116. 1939.), as shown by his having placed *Peniophora hastata* Litsch. in synonymy with it. The types of the two species are quite different, the former agreeing well in essential characters with specimens commonly referred to *P. rudis* or *P. subcremea.* One of the most characteristic features of the majority of such collections is the presence of a subicular layer of variable thickness, of thick-walled subcapillary hyphae 2.5–3.5 μ in diameter, clamp-bearing and often parallel-conglutinate. In occasional collections these basal hyphae are very scarce and easily overlooked. The type of *C. Greschikii* is such a collection.

P. alba was based on a single Canadian collection made by J. Macoun which shows the essential features of *P. subcremea* and *P. Greschikii.* Burt describes both cystidia and gloeocystidia, but these seem to be only aspects of a single structure. The cystidia are obtuse, ventricose-subulate, thin-walled, and emergent for nearly their entire length. Typical spores are subcylindric, 5–6 x 2–2.5 μ; Bourdot's variety seems to be based on spores obliquely drawn out at the apiculus. The types of the four species here placed in synonymy agree with each other in spore measurements, almost to the micron.

The species is not uncommon in Canada and the northern United States. Seven collections from Ontario are so assigned in the herbarium of the University of Toronto. Burt recorded two collections under *P. subcremea,* both of which are the same thing. Three of the seven collections recorded by Burt under *P. subapiculata* Bres. (q. v.) prove to be this species.

PENIOPHORA ALBO-STRAMINEA Bres. = **Corticium geogenium** Bres.

Corticium geogenium Bres., Ann. Mycol. **1:** 99. 1903 (!!).

Gloeocystidium inaequale Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **116,** I: 826. 1907 (!!).

Corticium inaequale (Höhn. & Litsch.) Sacc. & Trott., Syll. Fung. **21:** 401. 1912.

Gloeocystidium tenue subsp. *inaequale* (Höhn. & Litsch.) Bourd. & Galz., Soc. Mycol. Fr. Bul. **28:** 365. [1913]; Hymén. de France p. 257. [1928].

Peniophora albo-straminea Bres., Mycologia **17:** 69. 1925 (!!); Burt, Missouri Bot. Gard. Ann. **12:** 305 [1926].

Corticium albo-stramineum (Bres.) Overh., Mycologia **30:** 275. 1938; nec *Corti-*

cium albo-stramineum (Bres.) Wakef., Br. Mycol. Soc. Trans. **4**: 118. 1913 (= *Hypochnus albo-stramineus* Bres., Ann. Mycol. **1**: 110. 1903.).

Gloeocystidium albo-stramineum (Bres.) Overh., Mycologia **30**: 276. 1938; nec *G. albo-stramineum* (Bres.) Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **117**, I: 1097. 1908 (= *H. albo-stramineus* Bres.).

This species is a gloeocystidiate form, usually with prominently projecting cylindrical gloeocystidia, as was pointed out by Overholts. It may be recognized among related species by the non-amyloid, ellipsoid spores 6–8.5 x 4–4.5 μ, not appreciably flattened on one side, with slightly thickened walls. It may occur on wood or bark of either coniferous or deciduous trees. The species has apparently not been collected frequently in North America. Two or three collections were made by Weir at the type locality of *P. albo-straminea*, all on *Alnus tenuifolia*. One collection made in Ontario has been assigned to this species. The Vermont collection cited by Burt under *Corticium ermineum* (q. v.) belongs here. It has been reported correctly (as *C. albo-stramineum* (Bres.) Overh.) from Manitoba by Bisby *et al.* (Fungi of Manitoba and Saskatchewan p. 75. 1938.). The collection from California listed by Burt as *P. albo-straminea* is sterile and cannot be identified, but is certainly not the present species.

Von Höhnel & Litschauer (K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **117**, I: 1087. 1908.), on the basis of the description and a specimen (Jaap. Sachsenwald. 1904) received from Bresadola labeled *Gloeocystidium Bourdotii* Bres. n. sp., which they assumed to be the same as *G. praetermissum* var. *Bourdotii* Bres. (Ann. Mycol. **6**: 44. 1908.), place the latter in synonymy under *G. inaequale*. The collection cited has been examined and is certainly that species. However, Bourdot & Galzin (Hymén. de France p. 252. [1928].) list this variety, which is based on collections from Allier, France, under *Gloeocystidium luridum* (Bres.) Höhn. & Litsch. No authentic collections from France are available for study.

PENIOPHORA ALBULA Atk. & Burt = **Corticium albulum** (Atk. & Burt) comb. nov.

Peniophora Torrendii Bres. apud Torrend. Brotéria Ser. Bot. **11**: 77. 1913 (!!); Bourd. & Galz., Hymén. de France p. 315. [1928]; nec *Corticium Torrendii* Bres., I. R. Accad. Agiati Atti III, **8**: 131. 1902 (= *Gloeocystidium Torrendii* (Bres.) Bres., Brotéria Ser. Bot. **11**: 81. 1913.).

Peniophora albula Atk. & Burt apud Burt, Missouri Bot. Gard. Ann. **12**: 231. [1926] (!!).

Peniophora Burkii Burt. Missouri Bot. Gard. Ann. **12**: 282. [1926] (!!).

Corticium albulum (Atk. & Burt) comb. nov.

The so-called cystidia described for this species are best interpreted as gloeocystidia which may project slightly. Among forms so characterized this species may be readily recognized by the spores which are non-amyloid, obovate, slightly flattened at one side below the middle, with lateral apiculus, 6–8 x 4–5 μ; these tend to cling together in groups of two to four. The gloeocystidia are often rather scarce, flexuous or more commonly subfusiform, 30–50 x 6–7 μ, tapering to an obtuse apex.

PENIOPHORA ALLESCHERI (Bres.) Sacc. & Syd. = **P. mutata** (Peck) Höhn. & Litsch.

Corticium mutatum Peck, New York State Mus. Rept. **43**: 69. 1890 (!).
Corticium Allescheri Bres., Fungi Trident. **2**: 62. 1898 (!!).
Peniophora Allescheri (Bres.) Sacc. & Syd., Syll. Fung. **16**: 194. 1902; Burt, Missouri Bot. Gard. Ann. **12**: 301. [1926].
Kneiffia Allescheri (Bres.) Bres., Ann. Mycol. **1**: 100. 1903.
Peniophora mutata (Peck) Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **115,** I: 1580. 1906; Burt, Missouri Bot. Gard. Ann. **12**: 299. [1926].
Gloeopeniophora Allescheri (Bres.) Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **117**: I: 1082. 1908.
Peniophora cremea subsp. *Allescheri* (Bres.) Bourd. & Galz., Hymén. de France p. 304. [1928], quantum ad typum, descr. excl.
Peniophora cremea var. *Allescheri* (Bres.) Litsch., Österr. Bot. Zeitschr. **88**: 117. 1939, quantum ad typum.

Bresadola cites specimens from Bavaria, collected by Allescher, and from Italy. Since the fungus is named after Allescher, his collection is properly to be taken as the type. A part of it is in the Burt herbarium; it agrees extremely well, as Burt has pointed out, with the upper figure in Bresadola's plate; and equally well with Peck's *C. mutatum*. Von Höhnel & Litschauer (1908), and Bourdot have both indicated that two species were included in the original material, the present one and *P. cremea* (Bres.) Sacc. & Syd. Bourdot's subspecies and Litschauer's variety are described from the "*cremea*" portion; nevertheless, being based on "*Allescheri*," and hence on its type, they must be included here.

PENIOPHORA ALUTARIA Burt = **P. pallidula** (Bres.) Bres.

Gonatobotrys pallidula Bres., Ann. Mycol. **1**: 127. 1903 (!!).
Gloeocystidium oleosum Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **116,** I: 827. 1907 (!!).
Gloeocystidium pallidulum (Bres.) Höhn. & Litsch., Österr. Bot. Zeitschr. **58**: 471. 1908.
Corticium oleosum (Höhn. & Litsch.) Sacc. & Trav., Syll. Fung. **19**: 437. 1910.
Peniophora pallidula (Bres.) Bres. apud Bourd. & Galz., Soc. Mycol. Fr. Bul. **28**: 390. [1913]; Hymén. de France p. 296. [1928].
Peniophora pallidula var. *regenerans* Bourd. & Galz., Soc. Mycol. Fr. Bul. **28**: 390. [1913]; Hymén. de France p. 296. [1928].
Peniophora alutaria Burt, Missouri Bot. Gard. Ann. **12**: 332. [1926] (!!).
Peniophora laminata Burt, Missouri Bot. Gard. Ann. **12**: 246. [1926] (!!).

This is apparently one of the most common species in northern North America, although it was not recognized by Burt, except under his new names to which were assigned only three specimens all told. The two Canadian collections made by J. Macoun and cited by Burt as *Peniophora Odontioides* Burt (l. c. p. 224) are this species and this fact perhaps accounts for his having described the cystidia of the former as septate, since they are not so in the type collection. *P. pallidula* has also been encountered among collections assigned by him to *Peniophora subapiculata* (Bres.) Burt (q. v.).

The species is quite variable in character of both basidia and spores, as is suggested by the varieties described by Bourdot & Galzin (l. c.).

P. laminata Burt corresponds to the var. *regenerans* Bourd. & Galz. *P. alutaria* is based on a form at least as common in America as the typical one, a form whose cystidia show fewer septa and less irregularity in diameter, whose spores are consistently larger, and which bears in the hymenium numerous slender acicular cystidia with a sharp, barb-like terminal incrustation — like those illustrated by Miller (Mycologia **26:** pl. 3, fig. 4. 1934.) and by Bourdot (Hymén. de France, fig. 114) for *Odontia arguta.* There is some doubt whether *P. pallidula* is separable from *O. arguta;* it is retained for the present.

PENIOPHORA ARACHNOIDEA Burt = **P. cremea** (Bres.) Sacc. & Syd.

Corticium sordidum Karst., Soc. Faun. Fl. Fenn. Med. **9:** 65. 1882 (!).

Corticium cremeum Bres., Fungi Trident. **2:** 63. 1898 (!).

Peniophora cremea (Bres.) Sacc. & Syd., Syll. Fung. **16:** 195. 1902; Burt, Missouri Bot. Gard. Ann. **12:** 261. [1926]; Bourd. & Galz., Hymén. de France p. 303. [1928].

Corticium Eichlerianum (Bres.) Bres., Ann. Mycol. **1:** 95. 1903 (!!).

Kneiffia cremea Bres., Ann. Mycol. **1:** 100. 1903.

Peniophora sordida (Karst.) Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **115,** I: 1559. 1906 (Oct. ?); Burt, Missouri Bot. Gard. Ann. **12:** 280. [1926]; Bourd. & Galz., Hymén. de France p. 305. [1928]; nec *P. sordida* (Schroet.) Höhn. & Litsch., Ann. Mycol. **4:** 290. 1906 (June).

Peniophora cremea var. *glaucescens* Bourd. & Galz., Soc. Mycol. Fr. Bul. **28:** 396. [1913].

Peniophora Eichleriana (Bres.) Bourd. & Galz., Soc. Mycol. Fr. Bul. **28:** 397. [1913]; nec *P. Eichleriana* sensu Bourd. & Galz., Hymén. de France p. 306. [1928].

Peniophora arachnoidea Burt, Missouri Bot. Gard. Ann. **12:** 220. [1926] (!!).

Peniophora cremea var. *Eichleriana* (Bres.) Bourd. & Galz., Hymén. de France p. 304. [1928].

Cerocorticium albissimum Rick, Brotéria Sér. Trim. Ciênc. Nat. **3:** 169. 1934 (!).

The type of *P. arachnoidea* Burt is as here indicated. Some of the other collections assigned to *P. arachnoidea* by Burt are *P. byssoides* (Pers. ex Fries) Bres. (see under *Coniophora byssoidea*); others are a white form of the latter which may well be *P. byssoides* subsp. *Tomentella* (Bres.) Bourd. & Galz. if that subspecies can be recognized as distinct from *P. byssoides.* The description provided by Burt would appear to be a composite one, certainly not drawn exclusively or even mainly from the designated type.

Corticium sordidum, as represented by an authentic specimen in Burt's herbarium and also by Bourdot's description, is a name applied to older specimens of *C. cremeum;* both Bourdot and Burt remark the stratification of their specimens. The largest subicular hyphae in the Karsten specimen studied occasionally attain a diameter of 12 μ, and have thicker walls than ordinarily occur in *P. cremea,* but most hyphae are exactly the same; for the most part, this material and the Bresadola material of *P. cremea* agree well. The cystidia in *C. sordidum* are mostly engulfed by the thickening mycelium, and the tips which protrude are mostly broken; but the organs are the same in the two specimens.

Having already transferred Schroeter's *Hypochnus sordidus* to *Peniophora* (see under *P. Peckii*), von Höhnel & Litschauer discovered Karsten's earlier *Corticium sordidum* and likewise published it as a *Peniophora*, renaming the earlier fungus *P. sordidella*. The binomial had then been published twice before Burt sought to create it again (l. c.). Because of the existence of *P. sordida* (Schroet.) Höhn. & Litsch., Bresadola's later *C. cremeum* furnishes the name for the species.

Von Höhnel & Litschauer (K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **117**, I: 1082. 1908.) reduced *C. Eichlerianum* to synonymy under *Peniophora velutina* ([DC.] ex Pers.) Cooke. To this Bresadola objected (Ann. Mycol. **9**: 425. 1911.), asserting that there were no cystidia present. In the type specimen, however, there are cystidia, differing in no way from those of *P. cremea;* they are somewhat scattered, and for the most part broken. Bourdot & Galzin, having published *P. Eichleriana* on the basis of the type specimen of Bresadola's *Corticium*, in 1928 reduced that form to varietal status under *P. cremea* and sought to use the specific name *P. Eichleriana* for another collection, identified by Bresadola as *C. Eichlerianum*, but quite a different species. Clearly that other species must have another name.

PENIPHORA ARGENTEA Ellis & Everh. ex Burt Excluded.

P. argentea Ellis & Everh. in herb. ex Burt (Missouri Bot. Gard. Ann. **12**: 346. [1926].) is based on a thin sterile fungus growth whose distorted, conical seta-like structures and color-reaction in KOH seem to be those of an abortive *Hymenochaete*. The silvery surface layer which gave the specific name appears to be amorphous; at least in stained preparations there is no indication of protoplasm or hyphal structure in it. The name should be dropped.

PENIOPHORA ASPERIPILATA Burt = **P. longispora** (Pat.) Höhn.

Hypochnus longisporus Pat., Jour. de Bot. **8**: 221. 1894 (!!).
Kneiffia longispora (Pat.) Bres., Ann. Mycol. **1**: 105. 1903.
Peniophora longispora (Pat.) Höhn., Ann. Mycol. **3**: 325. 1905; Burt, Missouri Bot. Gard. Ann. **12**: 229. [1926]; Bourd. & Galz., Hymén. de France p. 298. [1928].
Peniophora longispora var. *mycelialis*, var. *gloeocystidiata*, var. *clavispora*, var. *cylindrospora* Bourd. & Galz., Soc. Mycol. Fr. Bul. **28**: 392. [1913]; Hymén. de France p. 298. [1928].
Peniophora asperipilata Burt, Missouri Bot. Gard. Ann. **12**: 230. [1926] (!!).

An examination of the portions of the type collection of *P. asperipilata* in the Burt herbarium and in the herbarium of the United States Department of Agriculture leaves no doubt that this is *P. longispora*. The characteristic elongated subfusiform spores of that species are present in both portions. Burt described the spores as "subglobose, 3½–4 μ in diameter"; no such spores could be found. The paratype, Lloyd Herb. *2395*, is the same species.

PENIOPHORA BURKII Burt = **Corticium albulum** (Atk. & Burt)

See under *Peniophora albula* Atk. & Burt

PENIOPHORA CANADENSIS Burt = **P. polonensis** (Bres.) Höhn. & Litsch.

Kneiffia polonensis Bres., Ann. Mycol. **1**: 103. 1903 (!!).

Peniophora polonensis (Bres.) Höhn. & Litsch., Ann. Mycol. **4**: 292. 1906 (falso ut "poloniensis"); Bourd. & Galz., Hymén. de France p. 315. [1928].

Peniophora canadensis Burt, Missouri Bot. Gard. Ann. **12**: 260. [1926] (!!).

Two collections of *P. canadensis* are recorded by Burt. Both are identical with the Bresadola species. The fungus is apparently common in northeastern North America, as shown by over thirty Ontario collections in the University of Toronto herbarium.

PENIOPHORA DELECTANS Overh. = **P. calothrix** (Pat.) comb. nov.

Corticium calothrix Pat., Cat. Rais. Pl. Cel. Tunisie p. 59. 1897 (!!).

Peniophora glebulosa subsp. *Pirina* Bourd. & Galz., Soc. Mycol. Fr. Bul. **28**: 387. [1913].

Peniophora Pirina (Bourd. & Galz.) Bourd. & Galz., Hymén. de France p. 290. [1928].

Peniophora delectans Overh., Mycologia **26**: 513. 1934 (!!).

Peniophora calothrix (Pat.) comb. nov.

Readily distinguishable among the species of *Peniophora* sect. *Tuliferae* by the cystidia, which have the lumen capillary below and expanded towards the tip, leaving the outermost portion thin-walled except for a narrow region extending along one side and over the summit, forming a sort of hood of thicker material. Not common, but collected on both coasts, in Iowa, and as far south as Tennessee.

PENIOPHORA DISSOLUTA Overh. = **P. chaetophora** (Höhn.) Höhn. & Litsch.

Hypochnus chaetophorus Höhn., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **111**, I: 1007. 1902 (!!).

Peniophora chaetophora (Höhn.) Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **116**, I: 748. 1907; Bourd. & Galz., Hymén. de France p. 287. [1928].

Peniophora dissoluta Overh., Mycologia **26**: 514. 1934 (!!).

The fungus described by Overholts from Pennsylvania is a thin young growth of *P. chaetophora*, like the margins of older and more mature collections. The species is common in eastern Canada and western Oregon, and probably elsewhere also. It is well represented by von Höhnel & Litschauer's figure (l. c.).

PENIOPHORA FLAMMEA Burt = **P. ludoviciana** Burt

Peniophora ludoviciana Burt, Missouri Bot. Gard. Ann. **12**: 244. [1926] (!!).

Peniophora flammea Burt, Missouri Bot. Gard. Ann. **12**: 252. [1926] (!!).

The fructification of this species is brilliant greenish yellow — Primuline Yellow, Old Gold, Olive Lake (R) — and soft-waxy when fresh; on drying the color becomes a brownish buff; and since it is the latter shades that are described (l. c.), the species has been hard to identify because of the striking appearance of fresh material. The cystidia are

for some time even and thin-walled, but finally become incrusted; in the latter condition they become the sole diagnostic character of *P. flammea*. The types of both species show both stages in cystidial development and both represent a thin form of the species which commonly occurs in thicker fructifications than allowed by Burt's descriptions.

PENIOPHORA GLEBULOSA (Fries) Sacc. & Syd. Nomen confusum.

See under *Corticium calceum* sensu Romell & Burt.

PENIOPHORA GLEBULOSA sensu Bres. & auctt. = **P. gracillima** Ellis & Everh. sp. nov. in sched.

Peniophora glebulosa sensu Bres., Burt, Missouri Bot. Gard. Ann. **12**: 282. [1926]; Bourd. & Galz., Hymén. de France p. 288. [1928]; nec *Thelephora calcea* * *glebulosa* Fries (nomen confusum).

(*Peniophora gracillima* Ellis & Everh. ex Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **116**, I: 743. 1907, pro synon.

Peniophora gracillima Ellis & Everh. sp. nov. in sched.[2]

Under *Corticium calceum* sensu Romell & Burt will be found a list of names all of which are based directly or indirectly on *Thelephora calcea* Pers. **glebulosa* Fries, the type of which is found to consist of a mixture of two species, and which is hence a *nomen confusum*.

The cystidiate species of this complex, which has been commonly known in Europe and America as *Peniophora glebulosa*, is therefore without a valid name. The herbarium name of Ellis & Everhart, which has appeared in the literature (Höhn. & Litsch. l. c.), is available and seems appropriate. It is here published, not as a new name but as a new species, in order that the type may be definitely fixed.

PENIOPHORA GLOBIFERA Ellis & Everh. = **P. gigantea** (Fries) Massee

Peniophora gigantea (Fries) Massee, Linn. Soc. Bot. Jour. **25**: 142. 1889; Burt, Missouri Bot. Gard. Ann. **12**: 216. [1926]; Bourd. & Galz., Hymén. de France p. 318. [1928], ubi synon.

Peniophora globifera Ellis & Everh., Amer. Nat. **31**: 340. 1897 (!!); Burt, Missouri Bot. Gard. Ann. **12**: 219. [1926].

Kneiffia globifera (Ellis & Everh.) Rick, Brotéria Ser. Trim. Ciênc. Nat. **3**: 77. 1934.

A comparison of the type of *P. globifera* with a series of collections of *P. gigantea* from Europe and North America leaves little doubt that the former is merely a variation of the latter. It seems an unnecessary and very doubtful species.

PENIOPHORA KAUFFMANII Burt = **P. heterocystidia** Burt

Peniophora heterocystidia Burt, Missouri Bot. Gard. Ann. **12**: 293. [1926] (!!).

Peniophora Kauffmanii Burt, Missouri Bot. Gard. Ann. **12**: 296. [1926] (!!).

[2] Fructificatio sub lente subtiliter pilosa, cystidiis setulosa, continua; hyphae 2.5–3.5 μ diam., rigidae, nodoso-septatae; cystidia subcylindracea, obtusa, 55–135 x 8–10 μ, in partibus basalibus et mediis crassiter tunicata, apicem versus canalicula abrupte expansa, ut tunica tenuis fit; basidia cylindraceo-clavata, 18–20 x 4–4.5 μ, sterigmata 4 gerentia; sporae cylindraceae, subrectae vel leniter curvae, 7–9 (–11) x 2 μ.

In ligno *Aceris* putrido, Newfield, N. J., Aug. 1885, J. B. Ellis, typus, in Farlow herb.

P. Kauffmanii was described from a single collection made by Kauffman in Kentucky. No mention was made of large cystidia (or compact aggregations of crystals) such as are usually characteristic of *P. heterocystidia,* and they do not occur in the portion of the type at the Missouri Botanical Garden. In the portion at the Farlow herbarium, however, and another received through Dr. Mains from the University of Michigan herbarium, they are clearly present in certain areas. There are no other differences, and the species are synonymous. *P. heterocystidia* is closely related to *P. mutata* (Peck) Höhn. & Litsch. (see under *P. Allescheri* Bres.).

PENIOPHORA LAEVIS sensu Burt = **P. affinis** Burt

Peniophora laevis sensu Burt apud Peck, New York State Mus. Bul. **54**: 954. 1902; Missouri Bot. Gard. Ann. **12**: 257. [1926]; Bourd. & Galz., Hymén. de France p. 307. [1928]; nec *Thelephora laevis* Pers. (Syn. Fung. p. 575. 1801.) ex Fries, Syst. Mycol. **1**: 451. 1821 (= *Corticium laeve* Pers., Roem. Neu. Mag. Bot. p. 110. 1794; Fries, Epicr. Syst. Mycol. p. 560. 1838; Burt, Missouri Bot. Gard. Ann. **13**: 280. 1926; Bourd. & Galz., Hymén. de France p. 183. [1928]; *Thelephora evolvens* Fries, Syst. Mycol. **1**: 441. 1821; *Corticium evolvens* (Fries) Fries, Epicr. Syst. Mycol. p. 557. 1838.).

Kneiffia laevis sensu Bres., Ann. Mycol. **1**: 100. 1903.

Peniophora affinis Burt, Missouri Bot. Gard. Ann. **12**: 266. [1926] (!!).

Peniophora laevis var. *affinis* (Burt) Litsch., Österr. Bot. Zeitschr. **88**: 117. 1939.

As in dealing with *Thelephora umbrina,* Burt here attempted to make a single published name do duty for two distinct species in two genera. *Thelephora laevis* Pers. ex Fries seems to be sufficiently well known; both Burt and Bourdot have described it under *Corticium laeve* and the former had a specimen from Persoon in his herbarium. Fries did not, of course, alter the diagnostic characters or circumscription of the *Thelephora* when he transferred it back to Persoon's original name, *Corticium laeve.* But sometime down the years he sent to Berkeley under that name a mis determined specimen with cystidia; that specimen is the basis of Burt's description of *P. laevis;* but the type of the *Corticium* is still the type of *T. laevis* Pers. ex Fries (i. e., as described in Burt under *C. laeve*). Fortunately Burt also published *P. affinis,* whose affinity to "*P. laevis*" is so great that they cannot be distinguished; the comb. nov. then drops out and the sp. nov. takes its place. It may be mentioned here, as indicated in the synonymy listed above, that there is only page priority in Fries to justify the use of *Corticium evolvens* to replace the more commonly used binomial *Corticium laeve.* Since page priority is not recognized by the Rules, and since *C. laeve* is well established by usage, we have not included a discussion of the latter in this series of notes. *Corticium calotrichum* Karst., cited by von Höhnel & Litschauer (K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **115,** I: 1550. 1906.) as synonymous with *P. laevis,* according to authentic material is wholly different.

PENIOPHORA LAMINATA Burt = **P. pallidula** Bres.

See under *P. alutaria* Burt.

PENIOPHORA LEPIDA Bres. = **P. aurantiaca** (Bres.) Höhn. & Litsch.

See under *Aleurodiscus Zelleri* Burt.

PENIOPHORA LIMONIA Burt = **P. sanguinea** (Fries) Höhn. & Litsch.

Peniophora sanguinea (Fries) Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **115,** I: 1588. 1906; Burt, Missouri Bot. Gard. Ann. **12:** 274. [1926], ubi synon; Bourd. & Galz., Hymén. de France p. 312. [1928].

Peniophora sanguinea subsp. *anaemacta* Bourd. & Galz., Soc. Mycol. Fr. Bul. **28:** 395. [1913]; Hymén. de France p. 313. [1928] (!).

Peniophora limonia Burt, Missouri Bot. Gard. Ann. **12:** 275. [1926] (!!).

Peniophora miniata sensu Burt, Missouri Bot. Gard. Ann. **12:** 277. [1926]; an *Thelephora miniata* Berk. in Smith, Engl. Fl. **5**(2): 168. 1836 (?!!); *Corticium miniatum* (Berk.) Berk., Grevillea **1:** 178. 1873. ?; vel *C. miniatum* Cooke, Grevillea **9:** 2. 1880. ?

According to Bourdot, *P. sanguinea* subsp. *anaemacta* is a cream-colored form with the "micrographic characters of *P. sanguinea*"; a specimen from him is marked: "Certissime cum *P. sanguinea* conjuncta!" Specimens answering this description are at hand from Iowa, where the red form seems not to develop, and elsewhere; the type of *P. limonia* is just such a fructification. The type distribution of *T. miniata* (Berk., Br. Fung. *251*) shows only sterile mycelium, as already noted by von Höhnel & Litschauer (l. c.); its true position is uncertain, but it probably belongs here. Fries assigned the same fungus to *C. sanguineum* (Summ. Veg. Scand. p. 334. 1849.). Specimens referred by Burt to *P. miniata* show the whole range of variation exhibited by *P. sanguinea*, including hyphal incrustation and staining of the woody substratum.

It seems easily possible that the present species should derive its name from *Thelephora bolaris* Pers. (Mycol. Eur. **1:** 138. 1822.), based on Sowerby's plate 291 of *Auricularia aurantiaca*. When Fries published his *Thelephora sanguinea* he had not yet seen that plate (cf. Elenchus Fung. **1:** 219. 1828.); but at the time of compiling the index to the "Systema" he apparently had done so, for he assigned both *T. bolaris* and *A. aurantiaca* to his later *T. sanguinea* (cf. Syst. Mycol. **3,** index 54, 185), as he did later in the "Epicrisis" (p. 561). Sowerby's plate assuredly resembles the present species, about as much as does Fries's own plate (Ic. Fung. **2:** 97, pl. 198, fig. 2. 1884.). But by the time he was writing the "Hymenomycetes Europaei," Fries had reverted to the opinion that Sowerby's — and hence Persoon's — fungus was a *Phlebia;* and the description bears out this surmise just sufficiently that for the present the later Friesian name is here retained.

PENIOPHORA MAGNAHYPHA Burt = **Pellicularia Langloisii** (Pat.) Rogers

Peniophora magnahypha Burt, Missouri Bot. Gard. Ann. **12:** 238. [1926].

Pellicularia Langloisii (Pat.) Rogers, Farlowia **1:** 101. 1943, ubi synon.

PENIOPHORA MINIATA sensu Burt = **P. sanguinea** (Fries) Höhn. & Litsch.

See under *Peniophora limonia* Burt.

PENIOPHORA ODORATA sensu Burt = **Peniophora luna** Romell in sched. sp. nov.

Stereum odoratum sensu Karst., Bidr. Känned. Finl. Nat. Folk **25**: 309. 1876; nec *S. odoratum* Fries, Epicr. Syst. Mycol. p. 553. 1838 (= *Thelephora odorata* Fries, Syst. Mycol. **1**: 445. 1821.).

Xerocarpus odoratus sensu Karst., Rev. Mycol. **3**(9): 22. 1881; Bidr. Känned. Finl. Nat. Folk **37**: 137. 1882, typo excluso.

Phanerochaete odorata sensu Karst., Bidr. Känned. Finl. Nat. Folk **54**: 186. 1894 (!), typo excluso.

Peniophora odorata sensu Burt, Missouri Bot. Gard. Ann. **12**: 289. [1926] (!); Bourd. & Galz., Hymén. de France p. 295. [1928], typo excluso.

Nec *Stereum Karstenii* Bres., I. R. Accad. Agiati Atti III **3**: 108. 1897.

Peniophora luna Romell in sched. sp. nov.[3]

No Friesian specimens are at hand to verify independently the statements of various authors (including Karsten himself, l. c., 1894), that the "odorata" of Karsten is not the Friesian species; but Fries's descriptions, and especially the long one (Fries, Elenchus Fung. **1**: 207. 1828.), tend to confirm that opinion. "Semper effusa, demum ad plures ulnas truncos ambiens"; "numquam rimoso-incisa, demum tota ut corium a truncis solubilis" — these words do not well describe the present notably pulvinate form, which only rarely, and only tardily, becomes confluent over even small areas, and which is often rimose. It is, of course, not permissible to choose a type for *P. odorata* from among Karsten collections so labeled, as Burt has done; the Karsten references clearly indicate that it is Fries's species with which he intended to deal. Since an appropriate name was at hand, on Romell material of the present species, it is here published — and as a new species, rather than a new name, in order that the type may be fixed beyond question. *Stereum Karstenii*, published by Bresadola for "*Xerocarpus odoratus* Karst. (nec. *Stereum odoratum* Fr.)," is apparently not available for the fungus here described; it is probable that Karsten, like Burt, confused *P. crassa* with the present species; Bresadola's description applies rather to the former (see under *Peniophora verticillata* Burt).

PENIOPHORA PECKII Burt = **Corticium punctulatum** Cooke

Corticium punctulatum Cooke, Grevillea **6**: 132. 1878 (!!); Burt, Missouri Bot. Gard. Ann. **13**: 179. 1926.

Hypochnus sordidus Schroet. in Cohn, Krypt.-Fl. Schles. **3**(1): 418. 1888.

Peniophora Eichleri Bres. apud Sacc. & Syd., Syll. Fung. **16**: 194. 1902 (!!).

Kneiffia Eichleri (Bres.) Bres., Ann. Mycol. **1**: 101. 1903.

Hypochnus cremicolor Bres., Ann. Mycol. **1**: 109. 1903.

[3] Fructificatio crassa, subpulvinata, margine distincto, hirsuto, hymenio alutaceo, sub lente subtiliter piloso, continuo vel rimoso; hyphae tenuiter tunicatae, nodoso-septatae, 2–4 μ diam., demum crasse tunicatae, compactae, paralleles; cystidia clavato-cylindracea, (60–) 90–230 x 7.5–12 μ, vel 30–75 μ emergentia, vel immersa, canalicula ad basim angusta, apicem versus gradatim expansa, tenuiter uni- vel pauciseptata; basidia clavato-cylindracea, 40–85 x 7.5–9.5 μ, inferne crasse tunicata, sterigmata 4 gerentia 7–9.5 x 2–3 μ; sporae sublunatae, utrinque obtusae, apiculo laterali obtusoque praeditae, 15–18 x 4.5–7 μ. — Suecia: Lappland, VIII.17.10, L. Romell *413*, **typus**; Bedarö, XII.25.10, L. Romell *412*; Stockholm, VI.20.09, L. Romell *369* (ut *Chaetocortic. fusisporum*); specim. omnia in herb. Burt in Farlow Herb.

Hypochnus albo-stramineus Bres., Ann. Mycol. **1**: 110. 1903 (!!).

Peniophora sordida (Schroet.) Höhn. & Litsch., Ann. Mycol. **4**: 290. 1906 (Jun.); K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **117**, I: 1097. 1908; nec *Peniophora sordida* (Karst.) Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **115**, I: 1559. 1906 (Oct.); Burt, Missouri Bot. Gard. Ann. **12**: 280. [1926]; Bourd. & Galz., Hymén. de France p. 305. [1928]; (= *Corticium sordidum* Karst., Soc. Faun. Fl. Fenn. Med. **9**: 65. 1882.).

Peniophora sordidella Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **115**, I: 1559. 1906; Bourd. & Galz., Hymén. de France p. 262. [1928].

Peniophora sphaerospora Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **115**, I: 1600. 1906 (!!).

Gloeocystidium Eichleri (Bres.) Höhn. & Litsch., Österr. Bot. Zeitschr. **58**: 331. 1908.

Tomentella albo-straminea (Bres.) Höhn. & Litsch., Österr. Bot. Zeitschr. **58**: 476. 1908.

Gloeocystidium albo-stramineum (Bres.) Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **117**, I: 1097. 1908; Bourd. & Galz., Hymén. de France p. 262. [1928]; nec *G. albo-stramineum* (Bres.) Overh., Mycologia **30**: 276. 1938 (= *Peniophora albo-straminea* Bres., Mycologia **17**: 69. 1925.).

Corticium albo-stramineum (Bres.) Wakef., Br. Mycol. Soc. Trans. **4**: 118. 1913; nec *C. albo-stramineum* (Bres.) Overh., Mycologia **30**: 275. 1938 (= *P. albo-straminea* Bres.).

Gloeocystidium cremicolor (Bres.) Bres. apud Bourd. & Galz., Soc. Mycol. Fr. Bul. **28**: 368. [1913].

Gloeocystidium albo-stramineum var. *causseanum* Bourd. & Galz., Soc. Mycol. Fr. Bul. **28**: 368. [1913]; Hymén. de France p. 262. [1928] (!!).

Peniophora Peckii Burt, Missouri Bot. Gard. Ann. **12**: 291. [1926] (!!).

Gloeocystidium albo-stramineum subsp. *Eichleri* (Bres.) Bourd. & Galz., Hymén. de France p. 263. [1928].

Gloeocystidium albo-stramineum subsp. *sphaerosporum* (Höhn. & Litsch.) Bourd. & Galz., Hymén. de France p. 262. [1928].

Gloeocystidium albo-stramineum subsp. *cremicolor* (Bres.) Bourd. & Galz., Hymén. de France p. 263. [1928].

Corticium punctulatum is readily recognizable by the rough- and thick-walled ellipsoid to subglobose spores, the colorless, obtuse, subcylindric gloeocystidia, and the loose mycelium, thick-walled near the substratum, thinner above, with prominent proliferating clamps throughout. There are certainly other species, closely related to this, with either the same structure or spores of similar description; but strangely enough they are not included among the type and authentic specimens indicated (by exclamation points) above. As in many gloeocystidiate fungi, the degree of exsertion of the gloeocystidia is determined largely by the maturity of the fungus, and varies within a single specimen; relative abundance and preservation of mycelium depends on the same factor. Most of the type of *C. punctulatum* has both mycelium and gloeocystidia partly disintegrated, but they are present, and characteristically shown about the margins.

It will be observed that authentic material of *H. sordidus* and *H. cremicolor* was not at hand for examination. Material of *P. sordidella* in the von Höhnel herbarium and of *G. cremicolor* from Bourdot's herbarium,

and the original decriptions, were used to determine the nature of those species.

PENIOPHORA PERTENUIS (Karst.) Burt = **P. tenuis** (Pat.) Massee

Corticium tenue Pat., Rev. Mycol. **7**: 152. 1885; Tab. Anal. Fung. **1**: 203. fig. 462. 1886.

Peniophora praetermissa Karst., Bidr. Känned. Finl. Nat. Folk **48**: 423. 1889 (!!).

Peniophora tenuis (Pat.) Massee, Linn. Soc. Bot. Jour. **25**: 149. 1889; Burt, Missouri Bot. Gard. Ann. **12**: 317. [1926].

Corticium pertenue Karst., Hedwigia **29**: 270. 1890 (!).

Corticium praetermissum (Karst.) Bres., Ann. Mycol. **1**: 100. 1903.

Kneiffia tenuis (Pat.) Bres., Ann. Mycol. **1**: 105. 1903; nec *K. tenuis* Pat., Soc. Mycol. Fr. Bul. **9**: 132. 1893.

Gloeocystidium praetermissum (Karst.) Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **115**, I: 1556, 1565. 1906.

Gloeocystidium tenue (Pat.) Höhn. & Litsch., Wiesner-Festschr. p. 70. 1908; Bourd. & Galz., Hymén. de France p. 256. [1928].

Gloeocystidium tenue subsp. *praetermissum* (Karst.) Bourd. & Galz., Soc. Mycol. Fr. Bul. **28**: 364. [1913]; Hymén. de France p. 256. [1928].

Peniophora pertenuis (Karst.) Burt, Missouri Bot. Gard. Ann. **12**: 315. [1926].

Gloeocystidium caliciferum Litsch., Österr. Bot. Zeitschr. **77**: 126. fig. 4. 1928 (!!); **88**: 115. 1939; Bourdot, Soc. Mycol. Fr. Bul. **48**: 213. 1932.

The *P. tenuis* complex is an abundant, variable, and difficult group. There is no material of Patouillard's species in his herbarium, and no record of anyone's having seen authentic material except himself. However, the descriptions and figure cited seem to define it quite precisely. He says "cystidia cylindric," and shows them approximately so; therefore in preliminary sorting, specimens belonging to the tenuis-complex were assigned to *P. tenuis sensu stricto* if the cystidia were long-emergent, of nearly uniform diameter, and scarcely capitate. A specimen of *P. pertenuis* whose data agree with those originally published, and which in consequence is taken to be the type, has its cystidia emergent, ventricose, quite slender above, and with a few mineral granules on the button-like apex. In preliminary study of this complex considerable numbers of specimens with similar cystidia were tentatively assigned to Karsten's species. There is much intergradation in various details between these two extreme phases, and only extremes are at all readily separable. Three authentic specimens of *P. praetermissa* were at hand; the best of these showed both types of cystidia in the one specimen. There are no other useful grounds for segregation; the species are therefore combined. Litschauer published under the name *G. caliciferum* a clear and careful account of a fungus characterized by unique caliciform gloeocystidioid bodies (for which see his illustration) in addition to the structures earlier ascribed to *P. tenuis*. Material exactly like his type has been examined from several localities in North America. However, caliciform bodies like those described by Litschauer are connected by numerous intergrading structures with simple globoid gloeocystidia; and both simple and highly differentiated structures occur in all the forms here included under *P. tenuis*. Furthermore, on two occasions Professor Litschauer

wrote that he had come to regard the whole complex as a single species, and that Bourdot was of the same mind. Although Bourdot previously (Soc. Myc., l. c.) and Litschauer subsequently (1939) recognized the autonomy of *G. caliciferum*, our ample material indicates the correctness of the opinion here quoted from Litschauer.

PENIOPHORA PHYLLOPHILA Massee = **Vararia phyllophila** (Massee) comb. nov.

? *Athelia epiphylla* Pers., Mycol. Eur. **1**: 84. 1822.
? *Thelephora epiphylla* (Pers.) Fries, Elenchus Fung. **1**: 226. 1828.
? *Hypochnus epiphyllus* (Pers.) Wallr., Fl. Krypt. Germ. **2**: 309. 1833.
Corticium epiphyllum sensu Rav., Fung. Amer. Exs. *457*. 1881; an *A. epiphylla* Pers. ?
Peniophora phyllophila Massee, Linn. Soc. Bot. Jour. **25**: 150. 1889 (!!); Burt, Missouri Bot. Gard. Ann. **12**: 241. [1926].
Asterostromella epiphylla (Pers.?) Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **116,** I: 773. fig. 3. 1907.
Vararia phyllophila (Massee) comb. nov.

Vararia phyllophila is readily separable by the extremely delicate, flagellate outer branches of the dichophyses, somewhat as in the left-hand member of von Höhnel & Litschauer's fig. 3d, but more decidedly curved toward the tips. No gloeocystidia, basidia, or spores were found in the Farlow Herbarium copy of Ravenel, but a portion in von Höhnel's herbarium of the specimen in the Berlin copy shows them all — the basidia not in the least as figured, the spores quite like the right-hand member of fig. 3b, lunate-acicular, 17–21 x 2.5–3.5 μ, the gloeocystidia with yellowish granular content. From the description, the Ravenel fungus might well be Persoon's, and since *C. epiphyllum* seems not to have been used for any other species from the time of its publication, Massee's substitution of a new name seems to have been a bit high-handed. There is no definite evidence, however, that *P. phyllophila* occurs in Europe; on the probability that that will continue to be the case, the later epithet is reluctantly accepted.

PENIOPHORA PICEINA Overh. = **Corticium Pini-canadensis** (Schw.) comb. nov.

Radulum Pini-canadensis Schw., Am. Phil. Soc. Trans. n. s. **4**: 164. [1832] (!!).
Peniophora Piceina Overh., Mycologia **22**: 238. 1930 (!!).
Corticium Pini-canadensis (Schw.) comb. nov.

This very characteristic species, well described by Overholts (l. c.), is so common that it is surprising that it has appeared in the literature so infrequently. Specimens are at hand from Ontario (20 collections) and Quebec, Maine, New Hampshire, Massachusetts, Connecticut, New York, Tennessee, and Pennsylvania. The New York record is based on a collection (Cornell Univ. *8072*) listed by Burt as a paratype of *Peniophora albula* Atk. & Burt.

The structures described by Overholts as cystidia seem best interpreted as gloeocystidia, hence the transfer to *Corticium* rather than to *Peniophora*. The portion of the type of *Radulum Pini-canadensis* in the Curtis herbarium is in an excellent state of preservation. The species occurs

not only on conifers, where it is most frequently found on small branches on the ground, but also on the bark of a variety of deciduous hosts.

PENIOPHORA SHEARI Burt = **P. aurantiaca** (Bres.) Höhn. & Litsch.

See under *Aleurodiscus Zelleri* Burt.

PENIOPHORA SORDIDA (Karst.) Höhn. & Litsch. = **P. cremea** (Bres.) Sacc. & Syd.

See under *Peniophora arachnoidea* Burt.

PENIOPHORA STRATOSA Burt = **P. Roumeguerii** (Bres.) Höhn. & Litsch.

Corticium Roumeguerii Bres., Fungi Trident. **2**: 36. 1892 (!!).
Peniophora Molleriana (Bres. in litt.) Sacc., Soc. Broteriana Bol. **11**: 13. 1893 (!).
Kneiffia Roumeguerii (Bres.) Bres., Ann. Mycol. **1**: 103. 1903.
Peniophora Roumeguerii (Bres.) Höhn. & Litsch., K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **115**, I: 1581. 1906; **116**, I: 789. 1907; Burt, Missouri Bot. Gard. Ann. **12**: 270. [1926]; Bourd. & Galz., Hymén. de France p. 316. [1928].
Peniophora stratosa Burt, Missouri Bot. Gard. Ann. **12**: 333. [1926] (!!); nec *P. stratosa* Petch, Roy. Bot. Gard. Peradeniya Ann. **9**: 293. 1925.

The type specimen of *P. stratosa* is only an especially thick fructification of a species which typically is quite thick; a slide in von Höhnel's collection of authentic material of *P. Molleriana* is equally stratose. The original description of *Kneiffia subascondita* Bres. (Ann. Mycol. **1**: 102. 1903.) is a good picture of the present species, and strongly suggests that, in reducing *P. subascondita* to subspecific rank under *P. Roumeguerii*, Bourdot & Galzin (Hymén. de France p. 317. [1928].) erred only in retaining it in any rank as distinct. However, a paratype of *P. subascondita* in Burt's herbarium differs in having much larger spores and clamp-bearing mycelium, and in other respects. For want of a specimen agreeing with the description, *P. subascondita* is not here listed as a synonym.

PENIOPHORA SUBAPICULATA (Bres.) Burt = **Corticium subapiculatum** Bres.

Corticium subapiculatum Bres., Mycologia **17**: 69. 1925 (!!).
Peniophora subapiculata (Bres.) Burt, Missouri Bot. Gard. Ann. **12**: 280. [1926].

Burt transferred *C. subapiculatum* Bres. to *Peniophora*. An examination of the type fails to reveal any cystidia. All of the six additional collections assigned to this species by Burt have been examined. Three of them prove to be *Peniophora Greschikii* (Bres.) Bourd. & Galz. (see under *P. alba* Burt), and two are *Peniophora pallidula* Bres., neither of which resembles *C. subapiculatum* at all closely. Only one (Weir *414*) from Evaro, Montana, is like the type. It is evident that Burt's description was not drawn from the type specimen and it is desirable, therefore, to restore Bresadola's species in *Corticium*.

PENIOPHORA SUBCREMA Höhn. & Litsch. = **P. Greschikii** (Bres.) Bourd. & Galz.

See discussion under *Peniophora alba* Burt.

PENIOPHORA SUBSULPHUREA (Karst.) Höhn. & Litsch.

See discussion under *Corticium subincarnatum* Peck.

PENIOPHORA TABACINA Burt = **P. dryina** (Berk. & Curt.)

See under *Coniophora dryina* (Berk. & Curt.) Massee.

PENIOPHORA TENUISSIMA Peck = **P. pubera** (Fries) Sacc.

Thelephora pubera Fries, Elenchus Fung. **1**: 215. 1828.
Hyphoderma puberum (Fries) Wallr., Fl. Krypt. Germ. **2**: 576. 1833.
Corticium puberum (Fries) Fries, Epicr. Syst. Mycol. p. 562. 1838.
Hymenochaete pubera (Fries) Lév., Ann. Sci. Nat. Bot. III **5**: 152. 1846.
Hypochnus puberus (Fries) Bon., Handb. p. 159. 1851.
Peniophora pubera (Fries) Sacc., Syll. Fung. **6**: 646. 1888; Burt, Missouri Bot. Gard. Ann. **12**: 313. [1926]; Bourd. & Galz., Hymén. de France p. 316. [1928].
Hypochnus subtilis Schroet. in Cohn, Krypt.-Fl. Schles. **3**(1): 418. 1888 (!!).
Peniophorella pubera (Fries ?) Karst., Bidr. Känned. Finl. Nat. Folk **48**: 427. 1889.
Kneiffia pubera (Fries) Bres., Ann. Mycol. **1**: 102. 1903.
Peniophora subtilis (Schroet.) Höhn. & Litsch., Ann. Mycol. **4**: 290. 1906; K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. **116**, I: 837. 1907.
Peniophora tenuissima Peck, New York State Mus. Bul. **157**: 114. 1912 (!!).

Peck's species was not included nor accounted for by Burt in his treatment of the genus. The type is quite typical of the less ceraceous collections of *P. pubera*.

Except for the type, all specimens cited as *P. subtilis* by Höhnel & Litschauer, and all in Höhnel's herbarium under that name, are *P. argillacea* Bres. The type, however, is a thin but perfectly characteristic specimen of *P. pubera*. Presumably one of the misdetermined collections is the basis for the inclusion, by Bourdot & Galzin (l. c., p. 279) of *P. subtilis* as a synonym of *P. argillacea*.

PENIOPHORA THUJAE Burt = **P. Sambuci** (Pers.) Burt

Thelephora sera Pers., Mycol. Eur. **1**: 151. 1822.
Thelephora Sambuci Pers., Mycol. Eur. **1**: 152. 1822.
Hypochnus serus (Pers.) Fries ex Wallr., Fl. Crypt. Germ. **2**: 310. 1833 (falso ut "sereus"); Karst., Bidr. Känned. Finl. Nat. Folk **25**: 320. 1876.
Corticium Sambuci (Pers.) Fries, Epicr. Syst. Mycol. p. 565. 1838; Donk, Nederl. Mycol. Ver. Med. **18–20**: 145. 1931.
Hypochnus Sambuci (Pers.) Bon., Handb. p. 159. 1851.
Corticium serum (Pers.) Fries, Hymen. Eur. p. 659. 1874; Bres., I. R. Accad. Agiati Atti III **3**: 112. 1897; R. E. Fries, Soc. Goth. Acta IV **3**: 37. 1900; Bourd. & Galz., Hymén. de France p. 203. [1928].
Lyomyces serus (Pers.) Karst., Rev. Mycol. **3**(9): 23. 1881 (ut "Lyomices").
Lyomyces Sambuci (Pers.) Karst., Bidr. Känned. Finl. Nat. Folk **37**: 153. 1882.
Kneiffia sera (Pers.) Karst., Hedwigia **28**: 195. 1889.
Corticium cretaceum [Fries] Cooke ex Sacc., Syll. Fung. **11**: 128. 1895.
Peniophora Sambuci (Pers.) Burt, Missouri Bot. Gard. Ann. **12**: 233. [1926].
Peniophora Thujae Burt, Missouri Bot. Gard. Ann. **12**: 236. [1926] (!!).

There are other synonyms, pre-Friesian, with which it seemed unnecessary to burden the list. While it is probable that what Fries and Karsten described under *C. serum* and *H. serus* was *Corticium bombycinum* (Sommerf.) Karst., such a misinterpretation of Persoon's species would not alter the synonymy (cf. R. E. Fries, Bresadola). Bresadola in his discussion places an exclamation point after *T. Sambuci*, thereby

presumably indicating that he had seen authentic material. It is the consensus of opinion that both specific names are equally available; but since *T. sera* has been repeatedly confused with other fungi (cf. Fries's synonymy, and Rogers, Mycologia **31**: 300. 1939.), "*Sambuci*" seems the preferable specific name. As to the preferable genus, there seems little choice between Bourdot's and Burt's treatment. The fungus is extremely common in eastern North America on a variety of coniferous and broad-leaved hosts. *P. Thujae* has no morphological characters by which to distinguish it; and specimens exactly like the type occur on wood of broad-leaved as well as coniferous species.

PENIOPHORA TRACHYTRICHA Ellis & Ev. = **P. aspera** (Pers.) Sacc.

See under *Corticium Berkeleyi* Cooke.

PENIOPHORA VERSATA Burt = **Corticium versatum** (Burt) comb. nov.

Peniophora versata Burt, Missouri Bot. Gard. Ann. **12**: 305. [1926] (!!).
Corticium versatum (Burt) comb. nov.

This species is a form in which the gloeocystidia may in part project prominently. There seems only one structure involved and the species is best included among the gloeocystidiate forms in *Corticium* where it would naturally be sought.

PENIOPHORA VERTICILLATA Burt = **P. crassa** Burt

Stereum Karstenii Bres., I. R. Accad. Agiati Atti III **3**: 108. 1897; Bourd. & Galz., Soc. Mycol. Fr. Bul. **37**: 126. 1921; Hymén. de France p. 385. [1928]; nec *Peniophora Karstenii* Massee, Linn. Soc. Bot. Jour. **25**: 153. 1889 (= *Phlebia coccineo-fulva* Schw., Am. Phil. Soc. Trans. n. s. **4**: 165. [1832]; *Peniophora coccineo-fulva* (Schw.) Burt, Missouri Bot. Gard. Ann. **12**: 253. [1926]); neque *Xerocarpus odoratus* sensu Karst., Rev. Mycol. **3**(9): 22. 1881 (= *Peniophora luna* Romell in sched. sp. nov. in hac re).

Peniophora crassa Burt ex Peck, New York State Mus. Rept. **54**: 155. 1901; Missouri Bot. Gard. Ann. **12**: 286. [1926].

Lloydella Karstenii (Bres.) Höhn. & Litsch., K. Akad. Wiss. Wien, Math.-Nat. Kl., Sitzungsb. **115**, I: 1568. 1906.

Peniophora verticillata Burt, Missouri Bot. Gard. Ann. **12**: 285. [1926] (!!).

Stereum Karstenii fa. *incrustata* Pilát, Soc. Mycol. Fr. Bul. **49**: 44. 1933.

P. verticillata was described from a single collection made in Oregon by S. M. Zeller. A comparison of this with a series of collections of *P. crassa* leaves no doubt as to their identity. The thick layer of substratal hyphae stressed by Burt, in his description of the former, is an unusual development due to the soft irregular surface of the substratum. Such a layer is often present in *P. crassa* when it occurs on bark. Burt states that no spores could be found. There is an abundance of the small allantoid spores characteristic of *P. crassa* in the type specimen. The character and arrangement of the incrusting granules on the projecting cystidia, stressed by Burt in his description of *P. verticillata*, and from which the name is derived, seem unessential. The cystidia in *P. crassa* may or may not be incrusted.

Bresadola's name was published to replace *Xerocarpus odoratus sensu* Karst. (*nec Stereum odoratum* Fries). Since, however, Karsten probably had two fungi confused in his *X. odoratus* (cf. under *Peniophora odorata sensu* Burt), the type of *S. Karstenii* must be the material Bresadola had in hand when describing the species. The line between *Stereum* and *Peniophora* is not always clear; this fungus appears to the present authors — as to Burt — to be a *Peniophora.*

SEBACINA

SEBACINA DEGLUBENS (Berk. and Curt.) Burt = **S. incrustans** (Pers. ex Fries) Tul.

Thelephora incrustans Pers. ex Fries, Syst. Mycol. **1**: 448. 1821.
Sebacina incrustans (Pers. ex Fries) Tul., Linn. Soc. Bot. Jour. **13**: 36. [1871]; Burt, Missouri Bot. Gard. Ann. **2**: 752. 1915; McGuire, Lloydia **4**: 12. 1941, ubi synon.
Corticium deglubens Berk. & Curt., Grevillea **1**: 166. 1873 (!!).
Sebacina deglubens (Berk. & Curt.) Burt, Missouri Bot. Gard. Ann. **2**: 755. 1915.

The type of *C. deglubens* is merely a rather thin fructification of *S. incrustans* growing over dead wood. Burt seems not to have been too happy in maintaining it as distinct.

SEBACINA FIBRILLOSA Burt = **Ceratobasidium fibrillosum** (Burt) comb. nov.

Sebacina fibrillosa Burt, Missouri Bot. Gard. Ann. **13**: 335. 1926 (!!).
Ceratobasidium fibrillosum (Burt) comb. nov.

Superficially appearing like a water-soaked sterile mycelium. Basidia stalked-obovate, quite like those of a *Sebacina* except that they lack septa. The (correct) impression that the fungus is related to the Tremellaceae is increased by the regular germination of the spores by repetition. In many respects this species is quite distinct from the published species of *Ceratobasidium* (cf. Rogers, Univ. Iowa Studies Nat. Hist. **17**: 4. 1935.); most obviously, in the possession of subcylindric cystidia.

SEBACINA POLYSCHISTA (Berk. & Curt. in herb.) Burt ? = **Corticium cremoricolor** Berk. & Curt.

Corticium cremoricolor Berk. & Curt., Grevillea **1**: 180. 1873 (!!); Burt, Missouri Bot. Gard. Ann. **13**: 218. 1926.
Sebacina polyschista (Berk. & Curt. in herb. sub *Corticio*) Burt, Missouri Bot. Gard. Ann. **13**: 338. 1926 (!!).

The type and only specimen is in very poor condition, and its determination must remain doubtful. Assuredly, however, it is not a *Sebacina;* and it appears to be a large-spored form of *C. cremoricolor.* It should never have been disinterred!

SEBACINA SCARIOSA (Berk. & Curt.) Burt ? Nomen confusum.

Corticium scariosum Berk. & Curt., Grevillea **2**: 3. 1873 (Jul.) (!!); nec *C. scariosum* Berk. & Br., Linn. Soc. Bot. Jour. **14**: 71. 1873 (Dec.).
Corticium secedens Sacc., Syll. Fung. **6**: 635. 1888.
Sebacina scariosa (Berk. & Curt.) Burt, Missouri Bot. Gard. Ann. **2**: 762. 1915.

The type and only collection is superficially much like *Peniophora gigantea*, and is so labeled in the Curtis herbarium. The surface, above the horny layer, is covered with a loose mealy crust of irregularly arranged large globose cells, sometimes wrinkled, but not cruciate-septate, apparently joined as are the conidia of *Cystopus*. Not certainly one fungus; probably an old fructification of *P. gigantea* or a similar form overgrown by a mold.

SISTOTREMA

SISTOTREMA sensu Donk and Rogers p. p. = **Trechispora** Karst.

The genus *Sistotrema* was earlier enlarged (cf. Rogers, Univ. Iowa Studies Nat. Hist. **17**: 19–23. 1935.) to include all species having the Urnigera type of basidia, whatever the form of the basidiocarp. It has seemed advantageous to separate the resupinate from the reflexed or stipitate forms. The genus *Trechispora* Karst. is available for the former group of species. Changes found necessary in the names used in that earlier paper are here listed for the sake of completeness. Cross reference to other names used in American literature which properly belong in *Trechispora* will be found in the proper alphabetical position in the preceding pages. More complete synonymy will be presented in a paper now in course of preparation.

SISTOTREMA CORONILLA (Höhn.) Donk = **Trechispora Brinkmanni** (Bres.)

See under *Corticium coronilla* Höhn.

SISTOTREMA SUBTRIGONOSPERMUM Rogers = **Trechispora subtrigonosperma** (Rogers) comb. nov.

TULASNELLA

TULASNELLA CALOSPORA (Boud.) Juel = **Gloeotulasnella calospora** (Boud.) Rogers

Tulasnella calospora (Boud.) Juel, Bih. Svensk. Vet.-Akad. Handl., Afd. 3, **23**(12): 23. 1897 (!!); Burt, Missouri Bot. Gard. Ann. **13**: 328. 1926; Bourd. & Galz., Hymén. de France p. 57. [1928].

Gloeotulasnella calospora (Bourd.) Rogers, Ann. Mycol. **31**: 201. 1933, ubi synon.

This species was placed in *Gloeotulasnella* because of consistency and basidial structure.

TULASNELLA EICHLERIANA Bres. = **T. violea** (Quél.) Bourd. & Galz.

Hypochnus violeus Quél., Assoc. Franç. Avanc. Sci. **1882**: 401. 1883 (!).

Tulasnella violea (Quél.) Bourd. & Galz., Soc. Mycol. Fr. Bul. **25**: 31. 1909; Hymén. de France 56. [1928]; Burt, Missouri Bot. Gard. Ann. **6**: 256. 1919; Overh., Torrey Bot. Club Bul. **49**: 166. 1922 (falso ut "Violae"); Rogers, Ann. Mycol. **31**: 184. 1933, ubi synon.

Tulasnella Eichleriana Bres., Ann. Mycol. **1**: 113. 1903 (!); Burt, Missouri Bot. Gard. Ann. **6**: 255. 1919.

The identity of the two species included by Burt has already been noted by Rogers.

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